THE MODERN PRECEPTOR;

OR,

A GENERAL COURSE OF EDUCATION:

CONTAINING

INTRODUCTORY TREATISES ON

LANGUAGE,	ASTRONOMY,
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GEOMETRY,	AGRICULTURE,
GEOGRAPHY,	GEOLOGY,

MORAL PHILOSOPHY.

FOR THE USE OF SCHOOLS.

ILLUSTRATED WITH PLATES AND MAPS.

BY JOHN DOUGALL.

IN TWO VOLUMES.

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THE

MODERN PRECEPTOR.

CHAPTER VI.

ON GEOGRAPHY.

BY GEOGRAPHY is meant that part of science which teaches the form of this earth which we inhabit, as also its several divisions into quarters, empires, kingdoms, and other states, with their respective boundaries and subdivisions, and the relative positions of countries, cities, towns, mountains, seas, lakes, rivers, and other remarkable objects on the earth's surface.

The term *geography* is formed from two Greek words, signifying, in general, a description of the earth, although the science has been divided into two branches, geography, properly so called, or a description of the land, and hydrography, or a description of the water or sea.

On the utility or importance of the study of geography it would be idle to expatiate: every person's experience must show that some acquaintance with it is indispensible in the ordinary intercourse and business of society; and hence we find, that to geography the attention of mankind was attracted from the earliest periods of history; at least,

so far as regarded descriptions of the various positions of the earth. The art, however, of representing such portions of the earth, on a plane surface, cannot well be traced back beyond the days of the Greek philosopher Thales, and his successor Anaximander, who, about the year 580 before the Christian era, produced a geographical table, perhaps a map, exhibiting the situation of Greece and the neighbouring countries.

After Anaximander came a succession of geographers, of whose writings, in general, only imperfect fragments have come down to our times: but, at last, in the reign of Augustus Cæsar, about the year 19 of Christ, appeared Strabo, a native of Amasia, in Lesser Asia, who composed a general system of geography, which has, happily, been preserved to our day, and which, besides topographical and historical informations concerning all such parts of the earth as were then known, many of which he had visited, contains sundry curious discussions on disputed points of geography, together with numerous extracts from the writings of prior travellers and geographers, which, but for Strabo's work, would have been utterly lost to the world.

Still, however, was wanting a treatise which, to the informations contained in the writings of Strabo and his predecessors, should add the philosophical and geometrical principles on which geography rests, as forming a part of the science of the universe. Such a treatise was produced, about a century and a half after Strabo, by Ptolemy the Alexandrian, containing instructions for the due construction of maps, for the representation of a sphere on a plane surface, and for determining the positions of countries, towns, &c. agreeably to their proper and relative situations on the surface of the earth, as ascertained by what is termed their latitude and longitude.

Of modern geographers it may be sufficient to mention the names of De Lisle and D'Anville in France, particularly

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the latter, who, for the learning and the sagacity displayed in his numerous dissertations on many portions of ancient and modern geography, as well as for his maps, deservedly enjoys the highest reputation: amongst ourselves, the labours of Rennell and Vincent are entitled to the greatest attention from every lover of genuine geographical discussion.

The uninformed and inconsiderate part of mankind, in modern, as well as in ancient times, have been of opinion, that this earth is a vast extended plane, bounded on all sides by the sea and the heavens: more attentive observers were, however, long ago persuaded that the earth is a round ball, globe, or sphere, maintaining its appointed place amongst the innumerable bodies composing the universe, and far removed from contact with any other body of either the same or a different kind.

How the ancients came to be convinced of the spherical form of the earth, we have now no means of discovering: but, by attending to the following facts, we may easily be led to adopt the same opinion. When we stand on the margin of a lake or arm of the sea of considerable breadth, and carefully observe such objects on the opposite side as seem to touch the surface of the water; if we stoop the eye slowly down to the ground, we will gradually lose sight of the objects we had at first remarked: on the contrary, if instead of lowering the eye we shall raise it, by ascending an eminence, climbing up a ship's mast, or the like, we will, as we ascend gradually, discover new objects lower than those at first noticed along the surface of the water, and their number will be increased in proportion to the height to which the eye is elevated.

These effects can be produced by no other cause than the rounded swelling surface of the water between the objects and the eye, which surface, if we take only a small portion of it, may, it is true, be considered as being perfectly level

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and horizontal, because the circle, of which this small portion is a part, is of so great a diameter, that the line joining the eye and the object, and the circumference, may be regarded as entirely coinciding: but when the portion of this circle is enlarged, the curvature of the surface will depart so sensibly from, and rise so much above the lines between the eye and the object, as entirely to intercept the view. (See this subject farther explained in Practical Geometry, page 437, vol. I.)

Again, when a ship leaves the land, the observers on shore first lose sight of her hull, and then of the lower sails, until, by increasing her distance, the tops of the masts themselves disappear: and, on the contrary, when a ship approaches the land, or another ship at sea, observers at a distance first perceive the top of her rigging, but as their distance lessens, more and more of the sails is discovered, and last of all the hull; which phenomenon can only be occasioned as before, by the round swelling surface of the water between the ship and the observers; and the effect is not confined to the surface of the sea, for those who have traversed the vast plains of Flanders, Lombardy, &c. must have observed similar appearances in the gradual discovery of steeples, towers, &c. in proportion as the intervening space was diminished.

Another proof that the earth is not a plane surface, but spherical, is drawn from the voyages repeatedly performed by those who have sailed round the world, who have, *in a general sense*, proceeded on in the same direction, some going always westward, others always castward, until they returned to the port where the voyage began.

An observer on board a vessel bound for India in the middle of winter, perceives that, as he quits the coast of England, and advances towards the Cape of Good Hope, standing in general in a southerly direction, the sun comes daily to approach more and more to be directly over him at noon, until at last this actually happens; and as he advances still

still farther on his course, the sun which at first appeared to bear to the southward of him, now bears to the northward: after he has doubled the Cape, however, and steers a course tending in general northerly, he again brings the sun directly over him at noon, before his arrival at Calcutta, when that luminary again appears always to the southward, as was the case before the traveller left England.

This appearance is not, however, confined to the sun, for as the observer proceeds to the southward from England, he will gradually discover stars appearing in the southern parts of the horizon, which had not before been seen, whilst others in the northern parts of the horizon, and even the north pole star itself, will gradually cease to appear, and those situated about the south pole will constantly be visible. If no interruptions from either land or bodies of ice presented themselves to the navigator, in steering his course still forward in the direction from north to south, he would pass under the south pole, and soon after discover the north pole, which, as he advanced in his voyage, would by degrees seem to rise higher and higher in the heavens, until he passed under it, and arrived at the place from which he sailed, when that pole would have regained the position it originally occupied in the hemisphere.

These several appearances, it must be evident, can only be explained on the supposition that the earth is not a flat circular plane, but a spherical body, totally unconnected with any other part of the universe.

In an eclipse of the moon, which, as shall be explained when we come to treat of astronomy, is occasioned by the earth coming in between her and the sun, and so intercepting his light, the boundary of the shadow of the earth, as it appears on the moon's body, is invariably of a circular form, which could not be the case if the body producing this shadow were not itself circular, and circular in all directions, or, in other words, spherical; for the eclipses of

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the moon happening in very various positions of the body of the earth, both with respect to her and to the sun, if that body were not a globe instead of a round flat surface like a table, the shadow cast on the moon would, at one time or other, assume the appearance of an ellipse, of a straight line, or of some other form different from that which it has constantly been found to present.

When the earth was understood to be a spherical body, attempts were naturally made to ascertain its dimensions. Eratosthenes, a celebrated geographer of Cyrene in Africa, and keeper of the Alexandrian Library, who was born 276 years before our era, by means of observations of the sun's meridian altitude at Alexandria and Syene, a town of Upper Egypt, nearly due south from Alexandria, calculated the circumference of the earth, supposing it to be a perfect sphere, to be 250,000 stadia, each stadium containing 547,4 English feet: consequently one degree, or the 360th part of the circumference would be $694\frac{4}{9}$ stadia, equal to about 71,24 English miles, and the whole circumference equal to about 25646,4 English miles, which exceeds the truth, but which is a wonderful approach to it, considering the very imperfect state of the science of geography in his time, as well as the defectiveness of the instruments he must have employed in his operations.

Ptolemy mentions other attempts made to ascertain the dimensions of the earth, and gives it as his own opinion, that the circumference was only 180,000 stadia; but when the various measures known by the ancients under the common name of stadium are considered, it appears that the dimensions here assigned were equal to about 24873 English miles, the 360th part of which, or 1 degree, would be 69,1 miles, which is but a little less than that now agreed upon since the latest observations.

When measurements for the purpose of determining the dimensions of the earth were made in later times on remote

parts

parts of its surface, the results were so far from agreeing one with another, that philosophers began to suspect the earth not to be a perfect sphere, all whose axes were equal; and the difficulty was to ascertain in what direction the longest and shortest axes were situated. From considerations arising from the nature of the earth itself, and the motions to which it is subjected, Sir Isaac Newton proved, that the shortest axis must be that which passes through the centre from north to south, and the longest that which passes through from east to west: this opinion was, however, combated by other learned men on the continent; but the repeated measurements of degrees on various and distant parts of the earth's surface, performed with the greatest care, and by means of the highly improved instruments of modern times, have fully established the general truth of Sir Isaac's theory. It has even been supposed that the axis passing through the centre of the earth, from west to east, is about 34 English miles longer than that which passes from north to south.

Upon taking a medium of all the different dimensions of the earth, it has been found that if it were a perfect sphere, the axis would be about 7,930 English miles, and consequently the circumference about 24,913 miles. Hence the superficial area of the globe would be about 197,560,000 square English miles, and the length of a degree on a great circle of such a sphere would be equal to 69,02 English miles.

When we observe the sun, the moon, and the stars begin regularly to appear or rise in the east, advance to their greatest elevation, and then disappear or set in the west, it is natural for us to imagine that these bodies are actually in motion from east to west, whilst we on the earth are perfectly fixed and motionless: but when our views of the magnitudes and distances of these bodies come to be more enlarged, we will be convinced that the same appearances may be produced, with respect to us, if we suppose that the whole

heavenly

heavenly host remains unmoved, while the globe we inhabit is equably turned round upon itself; just as a person who climbs a hill to enjoy an extensive prospect, obtains his wish by gradually turning himself round until he return to the point where he began, equally well as if, while he stood still, the whole surrounding landscape was rapidly moved about him, and thus made to bring each object in succession before his eyes. In the same manner, by a very simple and natural motion of the globe of the earth, turning round upon itself, the same appearances of the heavens are produced with respect to us, as if they were carried round the earth, with a motion rapid in proportion to the respective distances of the several bodies we observe.

If we pass a long needle through the centres of the flattened sides of an orange, and turn the orange round like a wheel upon this needle as an axis, we may have an idea of the manner in which the earth turns round upon itself: not that there is in the globe any thing corresponding to the axis or needle in the orange, any more than there is in the bowl when it rolls along the green; but for the sake of mutual comprehension it has been agreed on, amongst geographers and astronomers, to give the name axis to the imaginary line on which the earth revolves. The points where this imaginary line terminates on the surface of the globe, are called *poles*, from a Greek term, signifying to revolve. If this imaginary axis or line be supposed to be produced in both directions, until it apparently touch the surrounding heavens in two opposite points, these points will become the poles of the world, as far as regard our earth, for round these two points will the whole heavenly bodies seem to revolve, while the points themselves will appear to be at rest. To the point which is visible from our part of the globe we give the name of North Pole of the world, and the opposite, which cannot be perceived by us, is termed the South Pole.

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If we divide the whole space, contained between the northern and southern extremities of the axis of the earth, into two equal parts, and suppose a line to be drawn round the circumference of the globe, at that distance from the poles of the earth, such a line would divide the globe into two equal portions, or hemispheres, and thence it is termed the *equator*. It was already noticed that the circumference of every circle is by geometricians supposed to be divided into 360 equal parts, called degrees, (Vol. I. p. 383): if, therefore, we divide this surrounding line into 360 equal parts, each will be a degree on the earth's surface at the equator, or at its greatest distance from both poles: but supposing another great circle to be drawn on its surface passing through both poles, and crossing the equator at right angles, in two points diametrically opposite the one to the other, this circle, which is also to consist of 360 degrees, will be cut into 4 equal portions of 90 degrees each, extending from the north pole to the equator, from the equator to the south pole, from the south pole round to the opposite side of the equator, and from the equator back to the north pole; and the distance between the poles of the earth, or between any point of the equator, and another diametrically opposite to it, will be a semicircle, or 180 degrees.

All that part of the earth's surface which was known to the ancients, was of much greater extent from east to west than from north to south; for the temperate climates allowed them to penetrate much farther in the directions of the rising and setting sun, than towards the north, where eterna snows precluded all access, and to the south where intolerable heats, as they imagined, rendered it impossible for man to exist. Under such ideas it was natural for them to consider the easting and westing as the *length* of the earth, while the northing and southing was regarded as its *breadth*; hence the distance of any place, east or west from a given station,

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was called, agreeably to the Latin term which we have adopted, its *longitude*, and the distance of any place north or south from a given point they termed its *latitude*. Taking, therefore, the equator for the middle of the globe, equally distant from both poles, the latitude of any place is reckoned from it, being called north latitude when the place lies on the north side of the equator, and south latitude when the place lies on the south side of the equator. No place can have more than 90 degrees of latitude on either side, because 90 degrees is the whole distance between the equator and the poles: and the equator being a fixed, unalterable line surrounding the globe, latitudes may be calculated from any part of it.

The longitude of a place is calculated on the equator from a certain point chosen at pleasure, because in that circumference of the earth there is no natural limit whence it can be reckoned, as in the calculation of the latitude: it has therefore been the practice, in all times, ancient and modern, for geographers to assume the position of some remarkable island, cape, or town, from which all distances in easting or westing were to be counted: but as no proper situation may be conveniently found on the equatorial line of the earth, it becomes necessary to discover the point on that line which corresponds to some eligible spot on its north or south sides, from which the longitude may be reckoned.

Suppose we choose London as the spot from which longitude east or west is to be computed: if a circle be drawn through the poles of the earth, and passing over London, it will intersect the equator at right angles, and consequently at the shortest distance from London, in a point corresponding to the position of that city, from which point if longitude be reckoned, it may be considered as computed from London itself; and if 180 degrees are set off on the equator, in both directions, east and west, the one semicircle will indicate

indicate the longitude east, and the other the longitude west from London.

The circle just described as passing through the poles of the earth, and over London, is termed the *meridian* of that place. This name is borrowed from a Latin term signifying what relates to noon or mid-day; because when in the daily revolution of the earth this point comes to be turned directly towards the sun, he is then at his greatest apparent elevation, and consequently it is then mid-day or noon at London. As every spot on the face of the globe must have its own meridian, or point opposite to the sun at mid-day, the number of meridians must of course be indefinite: but having already made choice of London as the point from which to reckon the longitude, the great circle passing over it, and intersecting the equator, is termed the *first* meridian; and from this point of intersection the longitude is computed eastward and westward, with the same certainty as the latitude is counted northward and southward from the equator.

All great circles on the sphere being of equal magnitude, the meridian of London will contain the same number of degrees with the equator, and the arch intercepted between the pole and the equator being a quadrant, will contain 90 degrees: if then we measure the portion of the meridian intercepted between London and the equator, which will be found to contain 51 degrees, 30 minutes, 49 seconds, we say that London is situated in north latitude 51 degrees, 30 minutes, 49 seconds. In the same way by measuring the arch of the meridian passing over Edinburgh, intercepted between that place and the equator, we find it contains 55 degrees, 57 minutes, 5 seconds; we therefore say Edinburgh lies in north latitude 55°, 57′, 5″: thus also Dublin will be found to be situated in north latitude, 53°, 21′, 11″.

Again, if the place over which a meridian passes be situated between the equator and the south pole, its latitude

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will be termed southern ; as, for instance, the Cape of Good Hope, which lies in south latitude 33°, 55′, 12″; thus also Cape Horn, the most southerly point of South America, lies in south latitude 55°, 58′, 30″, and Botany Bay, in south latitude 34°, 6′.

When we compare the arches of the meridians of two places intercepted between each place and the equator, we discover the difference of latitude between the given places : thus the latitude of Edinburgh being 55°, 57′, 5″, and that of London being 51°, 30′, 49″, and both lying on the same side of the equator, by subtracting the less quantity from the greater, we obtain 4°, 26′, 16″, for the difference of latitude between London and Edinburgh ; that is, Edinburgh is situated 4°, 26′, 16″ farther to the northward of the equator than London. But if we wish to know the difference of latitude between two places on opposite sides of the equator, the one in north, and the other in south latitude, it is evident that as the two latitudes are calculated from the equator which lies between the two places, we must add the two latitudes together, when the sum will be the quantity of latitude between the given places ; thus, the latitude of London being 51°, 30′, 49″ northerly, and that of the Cape of Good Hope being 33°, 55′, 12″ southerly, by adding them together we obtain 85°, 26′, 1″, for the latitudinal difference between these two places.

If from either of the poles a number of concentric circles be drawn on the earth parallel to the equator, such circles will serve to point out the latitudes of the several places through which they pass, from which property they are called parallels of latitude ; and being described with radii successively less than that of the equator, these parallels will gradually diminish until at the poles they finally disappear. But such parallels being described with radii less than that of the globe, their planes would not pass through

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its centre, the parallels themselves would therefore not be termed great, but small circles of the sphere.

Having once established a first meridian from which the longitude of places on the earth is to be calculated, in order to discover the longitude of any place, or its longitudinal distance from that first meridian, we must suppose another meridian drawn through the poles and the given place, which must of course intersect the equator: and the distance of this point of intersection from that of the first meridian will point out the longitude of the given place, eastward or westward, agreeably to its position with regard to the first meridian.

Were it required, for instance, to know the longitude of Constantinople, reckoning from the first meridian passing through London, a great circle or meridian should be drawn through the poles, and passing over Constantinople, which would intersect the equator in a point 29°, 0′, 52″, to the eastward of that where the first meridian intersects the equator: consequently, the longitude of Constantinople would be 29°, 0′, 52″ east from London.

Again, if we wished to ascertain the longitude of Kingston in Jamaica, we should find that the meridian of that town could cut the equator in a point 77°, 0′, 28″, to the westward of the intersection of the first meridian, and consequently reckon Kingston to be in longitude 77°, 0′, 28″ west from London.

It has been the practice of many geographers to reckon the longitude from some first meridian eastward, quite round the equator, to the meridian where they began: but this practice is or ought now to be laid aside, as productive rather of confusion and labour, than of any utility; because, strictly speaking, no place can have from another more longitude than 180 degrees, or half the circumference of the equator: when, therefore, two places are situated on the same side of the first meridian, and that the most remote is

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not more than 180° from it, their difference of longitude will be found by subtracting the less from the greater. Should it, for instance, be required to know the difference of longitude between Constantinople, situated in longitude 29°, 0′, 52″, and Pekin, lying in 116°, 30′, 37″ both east from London, we have only to take the less quantity from the greater, for the difference of longitude required, which will be 87°, 29′, 45″. But when the two places are on opposite sides of the first meridian, and neither of them 90 degrees from it, the difference of longitude between them will be found by adding their respective longitudes together: thus the difference of longitude between Constantinople, situated in 29°, 0′, 52″ east from London, and Kingston in Jamaica, lying in longitude 77°, 0′, 28″ west from London, will be 106°, 1′, 20″.

Besides the revolution round its axis, in that portion of time which we call a day, the earth has another motion, by which it revolves round the sun, in that portion of time which we call a year. The path or figure described by the earth, in this annual motion round the sun, approaches nearly to a circle, but is in fact an ellipse, and is named the *ecliptic*. Whatever may have originally been the case, the plane of the ecliptic does not now coincide with the plane of the equator of the earth; that is, the axis of the earth is not perpendicular to the plane of the ecliptic, being inclined to it in an angle which, in 1769, was ascertained, by accurate observations, to be 66°, 31′, 50″; and, consequently, the plane of the earth's equator must then have formed, with the plane of the ecliptic, an angle equal to the complement of the former, or 23°, 28′, 10″; which angle is called the obliquity of the ecliptic. Had the plane of the equator coincided with that of the ecliptic, the earth in its progress round the sun would have had its axis perpendicular to its path, the globe would have been illuminated by the sun's rays constantly in the same manner, all the way from

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the north to the south pole, and the days and nights, produced by the diurnal revolution of the earth, by which all parts on its surface are successively exposed to his light, would have been constantly of the same length throughout the whole year. No sensible variation in the degrees of heat and cold, constituting that variety of seasons we now observe, especially in regions removed from the equator, would have been perceived: but from the oblique position of the earth's axis to the plane of its path in the ecliptic, proceeds that constant and regular variation we now experience, in the length of the day and night, and in the degree of heat and cold by which the different seasons of the year are distinguished:—in treating of astronomy this subject will be rendered more intelligible to the student.

As the earth in its annual course round the sun, moves in a plane not coinciding with that of its equator, these two planes must intersect each other in two points distant asunder one half of the earth's orbit, and when the earth is in these points, the earth's axis must of course be perpendicular to both planes, so that the sun's light is received equally on all parts of the globe, extending from pole to pole, and thereby causing the day and the night all over the world to be of equal length. From this circumstance it arises that these points of intersection are termed the *equinoctial points*, and simply the *equinoxes*.

In the middle point between these equinoctial points, when the earth's path is at its greatest distance from the plane of its equator, which is equal to the angle of the obliquity of the ecliptic, already stated to be 23°, 28′, 10″ the earth seems for some days to be stationary: and hence those intermediate points at equal distance from the equinoxes are called the *solstices*, a term signifying that the sun stands still, agreeably to the common notion, that all the phenomena of the seasons were occasioned not by the motion of the earth, but by that of the sun. When the earth is in

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one of these solstitial points, we have the longest day of the year, and when it is in the opposite solstice, we have the shortest day.

If from the equator on the earth's surface a space equal to the obliquity of the ecliptic, or 23°, 28′, 10″, be set off towards each pole, upon any meridian, and through that point circles be drawn from each pole, which must of course be parallel to the equator, these two circles will represent the earth's situation at the time of the solstices, where it begins to turn back towards the equator: and hence these circles are called *tropics*, from a Greek term signifying to return. That which lies on the north side of the equator is the tropic of Cancer, and that on the south side of the equator is the tropic of Capricorn, so named from certain clusters of stars, or constellations, to which they have a relation.

As the planes of the equator and the ecliptic intersect each other at an angle of 23°, 28′, 10″, it follows that the poles of a sphere, of which the plane of the ecliptic is a section perpendicular to its axis, must be situated at a corresponding distance from the poles of the equator, or of the earth: if then from the poles of the equator as centres, with a radius equal to 23°, 28′, 10″, circles be described, these circles will represent the various positions in which the poles of the ecliptic must be placed, and the path which they will describe, in the course of an annual revolution of the earth round the sun. The circle described about the north pole, is called the *arctic*; and that described about the south pole, is called the *antarctic* circle; denominations borrowed from the name of a constellation in that part of the heavens to which the northern extremity of the earth's axis is always directed. This constellation was called by the Greeks *arctos*, or the bear, in which is a bright star, known by the name of the Pole star, from its situation very near to the point in the heavens, through which the earth's axis,

axis, if produced northerly, would pass: in the Latin language this constellation is called *Ursa Minor*, and by us *the Little Bear*.

By means of these circles, which are in general called the polar circles, and the tropics, the surface of the globe is divided into five portions, extending from pole to pole, termed *zones*, or girdles: that which lies on both sides of the equator, and is bounded by the two tropics, is in breadth $23°, 28', 10'' \times 2 = 46°, 56', 20''$, and is called the *torrid* zone, on account of the intense heat which prevails in that middle region of the earth.

The spaces comprehended between the poles and the polar circles, each being in breadth 23°, 28′, 10″, are called the *frigid* zones, on account of the extreme cold experienced in those tracts of the globe.

The intermediate spaces lying between the tropics and the polar circles, each in breadth 43°, 03′, 40″, as extending from latitude 23°, 28′, 10″, to latitude 66°, 31′, 50″, are termed the *temperate* zones, on account of the moderate temperature of the atmosphere in those regions, equally removed from the heat of the torrid, and the cold of the frigid, zones.

Thus the surface of the earth is divided into one torrid zone, begirting its middle, two frigid zones surrounding the poles, and two temperate zones situated between the torrid and the frigid zones.

This division of the earth into zones being, however, too general for the purpose of ascertaining the positions of places with respect to each other, or to the equator, the ancients thought it necessary to subdivide its surface into other portions more minute.

The principle on which this subdivision was made, was the respective length of the day and the night, in different situations on the globe, at the summer solstice, or at the longest day of the year. Supposing the day and the night

to consist each of twelve hours at the equator, it was found that at the distance of 8°, 34′, on either side, the day consisted of 12½ hours: again, at the distance of 8°, 10′ more, or in latitude 16°, 44′ north and south, the day was observed to consist of 13 hours: and, in this manner, by observing the places where the day exceeded by ½ hour the length of that at a place before observed, a number of concentric circles was supposed to be described round the poles, through those places, and parallel to the equator, as high up as to the polar circles: and the narrow bands, or zones, included between these circles, were termed *climates*, from a Greek word signifying a gradual inclination; so that whatever was the length of the day at the spot through which was drawn the circle nearest to the equator, it was half an hour longer at the spot through which was drawn the adjoining circle nearest to the pole: but this division of the earth's surface is now seldom employed, and at any rate can be of very little service, since the introduction of the use of the parallels of latitude.

It was already observed that the earth not being a perfect sphere, but flattened at the poles, the difference between its axis and the diameter of the equator has by some been calculated at 34 English miles; and that a degree of latitude on either side of the equator, which may be considered as equal to a degree of longitude on the same line, contains about 69,2 English miles. Had the earth been a regular figure produced by the revolution on its shortest axis, of an ellipse whose transverse and conjugate axes differed by 34 miles, we might easily calculate the number of miles contained in a degree of latitude, at any distance from the equator; but from the measurements hitherto made, of degrees in different parts of the globe, so much uncertainty has resulted, that we must conclude either that the earth is not a solid produced by the revolution on its axis of any regular curve whatever, or that errors have occurred in the several

measure-

measurements, for which we are not yet able to account: it is, therefore, impossible to say from analogy what number of English miles, yards, feet, &c. exactly correspond to a degree of latitude at any given spot.

As the meridians all terminate in the poles, it is evident that whatever distance may be between any two at the equator, that distance must continually diminish to the poles, where it entirely disappears. If the earth were a perfect sphere, the length of a degree of longitude on any given parallel of latitude would be found by stating this proportion; as radius to the sine-complement of the latitude of the given place, so are the number of English miles in a degree of longitude on the equator, to the number in a degree of longitude at the given latitude: as, for example, if it be required to know how many English miles correspond to a degree of longitude at London, situated in north latitude 51°, 30′, 49″, by adding together the sine-complement of the latitude, and the logarithm of 69,2, the number of English miles in a degree of longitude on the equator, and subtracting radius from the sum, we have the logarithm of 43,06 miles, for the space on the surface of the earth at London, or in its parallel, corresponding to a degree of longitude: and on this principle has been calculated the following table, containing the length in English miles of a degree of longitude at every degree of latitude, from the equator to the poles, Viz.

TABLE.

Lat.	E. Miles.	Lat.	Miles.	Lat	Miles.	Lat.	Miles.
0	69,2000	23	63,6986	46	48,0705	69	24,7992
1	69,1896	24	63.2177	47	47,1914	70	23,6678
2	69,1578	25	62,7167	48	46,3038	71	22,5294
3	69,1052	26	62,1963	49	45,3994	72	21,3842
4	69,0312	27	61,6579	50	44,4811	73	20,2320
5	68,9363	28	61,1001	51	43,5489	74	19.0743
6	68,8208	29	60,5237	52	42,5037	75	17,9103
7	68,6845	30	59.9293	53	41,6453	76	16,7409
8	68,5267	31	59.3162	54	40,6751	77	15,5665
9	68,3481	32	58,6851	55	39,6917	78	14,3874
10	68,1489	33	58,0360	56	38,6959	79	13,2041
11	67,9288	34	57,3696	57	37,6891	80	12,0166
12	67,6380	35	56,6852	58	36,6705	81	10.8250
13	67,4264	36	55,9842	59	35,6408	82	9.6306
14	67,1448	37	55,2659	60	34 6000	83	8,4334
15	66,8424	38	54,5303	61	33,5489	84	7,2335
16	66,5192	39	53 7788	62	32,4873	85	6,0315
17	66,1760	40	53.0100	63	31,4161	86	4,8274
18	65,8134	41	52,2259	64	30,3352	87	3,6219
19	65,4300	42	51,4253	65	29,2453	88	2,4151
20	65,0265	43	50,6094	66	28,1464	89	1,2075
21	64,6037	44	49,7783	67	27,0385	90	0,0000
22	64,1609	45	48,9313	68	25,9230		

From this table it appears, that a degree of longitude on the equator may be considered as equal to the first degree of latitude on each side, or equal to 69,2 English statute miles, or 69¼ instead of 69½, or even 69⅓, both of which quantities give results greater than the truth. It will also be observed, that at the latitude of 60°, the degree of longitude is reduced to 34,6 English miles, or to one half of a degree on the equator; and that at the poles, or in latitude 90°, longitude disappears, because there the meridians uniting in one point, the intervals between them entirely vanish.

In

In the account laid before the Royal Society of London, in 1787, by the late Major General Roy, of the mode proposed to be followed in the trigonometrical operations for determining the relative situations of the Royal Observatories of Paris and Greenwich, are contained some very important observations on the magnitude and figure of the earth, together with tables of the degrees of latitude and longitude on its surface, calculated agreeably to various hypotheses, in particular to those of the celebrated French mathematician *Bouguer*. From these tables the following is extracted, exhibiting the lengths of degrees of latitude and longitude in English fathoms (of 6 feet each) calculated for every 5 degrees, from the equator to latitude 40°; from 41° to 60°, both included, for every single degree; and from 60° to the pole for every 5 degrees.

This table is founded on the hypothesis, that the earth, instead of being an ellipsoid of any proportionate axes, is a spheroid of such a description, that the lengths of the degrees of the meridian increase as they approach the pole, above that of a degree at the equator, in the proportion of the biquadratic, or fourth power, or squared squares of the sines of the latitudes. By this hypothesis the polar axis of the earth will be to the equatorial as 178,4 to 179,4; and, consequently, their difference will be 38,1 geographical miles, or 43,9 English miles; allowing 69,2 to be equal to a degree at the equator.

This difference between the axes is greater than that before mentioned, namely, 34 English miles; but, at the same time, the degrees of latitude, calculated upon this hypothesis, come much nearer to those actually measured on the earth, than such as result from calculations founded on any other supposed figure of the globe.

TABLE

TABLE

Of the Lengths of Degrees of Latitude and Longitude in English Fathoms of 6 Feet each, of which 880 are equal to 1 Statute Mile, calculated on the Hypothesis that the Increase of the Degree of the Meridian, above that at the Equator, follows the Ratio of the 4th Power, or squared Square, of the Sine of the Latitude.

Latitudes.				Lengths of Degrees of the Meridian in Fathoms.	Lengths of Degrees of Longitude in Fathoms.
	°	′	″		
	0	0	0	60484,50	61029,62
	5	—	—	60484,56	60799,34
	10	—	—	60485,43	60109,86
	15	—	—	60489,08	58968,53
	20	—	—	60498,49	57382,33
	25	—	—	60517,11	55362,39
	30	—	—	60548,38	52924,13
	35	—	—	60595,13	50085,13
	40	—	—	60658,99	46865,74
	41	—	—	60673,85	46178,12
	42	—	—	60689,40	45476,40
	43	—	—	60705,62	44760,77
	44	—	—	60722,50	44031,43
	45	—	—	60740,02	43288,58
	46	—	—	60758,17	42532,41
	47	—	—	60776,92	41763,17
	48	—	—	60796,24	40981,06
Paris	48	50	14	60812,83	40316,51
	49	—	—	60816,10	40186,26
	50	—	—	60836,47	39379,09
	50	5	—	60838,19	39311,29
	50	10	—	60839,92	39243,39
	50	15	—	60841,64	39175,37
	50	20	—	60843,37	39107,32
	50	25	—	60845,11	39039,18
	50	30	—	60846,84	38970,94

	50	35	—	60848 58	38902,62
	50	40	—	60850,32	3[illegible]8[illegible]4,22
	50	45	—	60852,07	38765,72
	50	50	—	60853,82	38697,15
	50	55	—	60855,57	38628,48
	51	—	—	60857,32	38559,72
	51	5	—	60859,08	38490,90
	51	10	—	60860,84	38422,00
	51	15	—	60862,61	38353,03
	51	20	—	60864 37	38283,97
	51	25	—	60866 14	38214,82
Greenwich	51	28	40	60867 14	38161,69
	51	30	—	60867,92	38145.57
	51	35	—	60869,69	38076,24
	51	40	—	60871,47	38006,83
	51	45	—	60873,25	37937,34
	51	30	—	60875,04	37867,77
	51	55	—	60876,82	37798,12
	52	—	—	60878,61	37728,40
	53	—	—	60900,30	36885,35
	54	—	—	60922,35	36030,83
	55	—	—	60944 70	35165,08
	56	—	—	60967 33	34288,36
	57	—	—	60990,16	33400,91
	58	—	—	610[illegible]3,16	32503,54
Equal to Deg. of Longitude on Equator.	58	42	47,4	61029,62	31856,42
	59	—	—	61036,27	31594,90
	60	—	—	61059,43	30676,86
	65	—	—	61174,10	25947,37
	70	—	—	61281,46	21012,06
	75	—	—	61374,25	15908.82
	80	—	—	61445,89	10677,85
	85	—	—	61491,13	5300 40
	90	—	—	61506,60	000

From

From this table it appears that the space occupied by the 1st degree of latitude from the equator, is 60484,5 fathoms, or very nearly 68,7324 English miles, while that occupied by a degree of longitude on the equator is 61029,62 fathoms, or very nearly 69,3519 miles, exceeding the 1st degree on the meridian by 545,12 fathoms, corresponding to ,6195 mile. It appears also, that until we arrive at latitude 58°, 42′, 47″ 4, the degree on the meridian continues less than that on the equator: and that we must go beyond the 60th degree of latitude before the degree of longitude be reduced to the half of one on the equator; whereas, on the supposition of the earth's being a sphere, the degree of longitude at the 60th degree of latitude ought to be precisely the half of one in the equator.

The surface of the earth is irregularly divided into portions of land and water, the former occupying but about one half of the space covered by the latter. The land is much varied by a succession of mountains, hills, vallies, and plains: and some mountains are elevated upwards of three English miles perpendicularly above the surface of the great body of waters: this elevation, however, being only about $\frac{1}{2640}$ part of the diameter, is such, that the earth may, in general, be regarded as presenting every where a smooth even surface.

The land on the globe is divided chiefly into two great portions; the one comprehending what was known to the ancients, and thence called the *Old World*, containing those tracts or quarters called Europe, Asia, and Africa, the other, which was only discovered in the end of the 15th century, and thence called the *New World*, containing North and South America.

Besides

Besides these vast masses of land, which, from the great space they occupy, are called *continents*, there are innumerable smaller portions scattered over the surface of the waters, and every where surrounded by them, which are hence called *islands*. Thus Britain, Ireland, Jamaica, Barbadoes, are islands, being on all sides detached from the continents, and inclosed by water. It is true, that both the Old and the New World are surrounded by water, and may, therefore, be considered as islands; but for distinction's sake, it is usual to apply this name only to smaller portions of land.

When a body of land is almost entirely inclosed by water, having only a narrow communication with a larger body, whether an island or a continent, it is termed a *peninsula*; and that narrow communication is called an *isthmus*. Thus Africa is a great peninsula, being surrounded by the sea on all sides, excepting at the north-east corner, where it is connected with Asia by the narrow neck of land or isthmus of Suez: Spain and Portugal form a peninsula connected with France by a broad isthmus, across which extend the Pyrenean mountains; the Morea, or Peloponnesus, is a peninsula united to Greece by the narrow isthmus of Corinth; and North and South America are two peninsulas united in the middle by the isthmus of Darien.

A point of land running out into the sea is called a *promontory*, and its extremity is termed a *cape*, or *headland*; such as the Land's End and the Lizard, which are headlands at the extremity of the great promontory of Cornwall; Cape Finisterre at the extremity of a promontory at the north-west corner of Spain; the Cape of Good Hope near the southern point of Africa, &c.

The great body of waters surrounding the four quaters of the earth is in general called the *sea* or the *ocean*; but to particular portions of this sea particular names are given. Thus that part situated between Europe and Africa on the

east,

east, and America on the west, is called the Atlantic ocean; the sea lying between America on the east, and Asia on the west, is called the Pacific ocean; the Indian ocean washes the east coast of Africa and the south coasts of Asia. Small portions of the sea, in a great degree inclosed by the land, have also their proper names, as the Mediterranean sea, which separates Europe from Africa; the Baltic sea, lying between Germany and Sweden, &c; the German sea, or ocean, between Britain and Holland, &c. the Irish sea, between England and Ireland; and even the vast expanse of water situated in the interior of Asia, entirely unconnected with the ocean, is, on account of its size, and a certain degree of saltness in the water, termed the Caspian sea. A smaller portion of water, in part surrounded by the land, is termed a bay, or gulf: such are the Bay of Biscay, otherwise called the Gulf of Gascony, embraced by the west coast of France and the north coast of Spain; the Gulf of Venice, part of the Mediterranean sea running in between Italy and Turkey in Europe; the Gulf of Mexico, dividing North from South America. Small indentings of the land, affording shelter for shipping, are also often called *bays*, as Torbay on the coast of Devonshire, Bantry Bay in Ireland. If such a place run but a little way into the land, it is generally called a *road* or *anchorage*, as the bay formed by the east coast of Kent, known by the name of the Downs, Yarmouth Roads, &c. When an opening into the land is made for the sea, at the mouth of a river, it is termed a *creek* or *cove*, and if of considerable size, a *channel*, as the Bristol channel. In Scotland such an opening or arm of the sea, at the mouth of a river, is called a *frith* or *firth*, such as the Frith of Forth on the east coast, and the Frith of Clyde on the west coast of that country. When two portions of the sea communicate together by means of a narrow pass or channel, such a pass is called a *strait* or *straits*; as, for instance, the Straits of Dover, by which the German ocean communicates with the

the English channel; the Straits of Gibraltar, uniting the Mediterranean sea with the Atlantic ocean; the Straits of Babelmandel, by which the Red sea, or Arabic Gulf, communicates with the Indian ocean. In the northern parts of Europe such a strait is often termed a *sound*, as the Sound of Mull, on the west coast of Scotland; and the much frequented pass between Denmark and Sweden, connecting the German ocean with the Baltic sea, is, for distinction's sake, called the Sound.

A body of water entirely inclosed by the land is called a *lake*, in Scotland a *loch*, and in Ireland a *lough*, (both words being of the same sound, although differently written); such as the Lake of Geneva in Switzerland, Lake Ladoga in Russia, the Lakes of Cumberland and Westmoreland, (which, with many other pieces of water in England, are commonly called *Meres*); Loch Lomond, Loch Tay, Loch Leven, &c. in Scotland; Lough Neagh, Killarney Lough, &c. in Ireland. The terms loch and lough are, however, often applied to pieces of salt-water running deep into the land, but having an open communication with the sea; as Loch Fyne on the west coast of Scotland, and Lough Foyle on the north coast of Ireland.

A large stream of water rising in the interior of a country, and flowing to the sea, or into some lake, is called a *river;* when the stream is small, it is termed a *rivulet* or *brook:* the word *bourne* or *burn*, so often met with in the names of places over England, and still used in its proper sense in Scotland, also signifies a rivulet or brook.

Although the sea appears to be stable, and confined to one particular situation on the globe, yet in many parts there are motions of the waters resembling the stream of a river: this stream is called a *current*, and in certain places it flows so rapidly as to require a strong wind to keep a vessel from being hurried along with it. When one current is opposed by another setting in a contrary direction, a circular motion

of the water is produced, which we call a *whirlpool*, such as the celebrated Charybdis, near Messina in Sicily, and the Maelstrom on the coast of Norway. Besides these partial currents, there are in certain parts near the equator, a continual setting of the waters of the ocean to the westward, as that which bears from the coast of Africa to the coast of South America, where it bends northerly, and enters the Gulf of Mexico, where it receives a contrary direction from the land, and turning towards the north-east, runs up the coast of North America, by the banks of Newfoundland, into the Atlantic ocean.

The sea is subject to another motion, by which it rises and falls twice in about 25 hours, flowing up on the shore, and retiring with great regularity. This motion, which is called the *tide*, or the *flowing* and *ebbing* of the sea, is closely connected with the state of the moon, being most observable when that luminary is new or full: but the precise periods of high and low water at any particular spot are so much affected by its local situation, that they can only be ascertained by observation and experience.

The globe of the earth is surrounded by a fine elastic fluid, commonly called the *air*, but more properly the *atmosphere*. This air is indispensibly requisite for the existence of all animals and vegetables, for the transmission to us of light from the heavenly bodies, and for the production of vapours, clouds, dews and rain. The atmosphere itself is perfectly colourless, and the bluish or other tints, which we observe in it, are produced by vapours floating in it. Air being elastic, is susceptible of augmentation or diminution of its bulk from various causes: by heat, for instance, it is rarefied and enlarged, and by cold it is condensed and diminished; when by heat the air is rarefied, the colder air in the neighbourhood being heavier, will naturally rush into the place where the air is thin and light, and by its motion create a stream or current, to which we give the name of *wind*.

In

In the temperate regions of the earth, where the heats are irregular, currents of air or winds will of course be variable, and proceed from all directions at different times; but some local circumstances may occasion certain winds to be more prevalent in one country than in another; thus, in Britain, the south-west winds are observed to be much more frequent than those from any other quarter.

In certain parts of the sea, at and on each side of the equator, where the heat of the sun occasions the most sensible and the most uniform changes in the temperature of the air, the rarefaction following the sun's course, the colder air rushes in from the eastward, and hence produces currents in general from east to west, during the whole year; to which, from their great utility to vessels employed in commerce, we have given the name of the *trade-winds*. It is to gain the assistance of this wind that vessels from Europe, bound for the West India islands, usually run a good way southwards on the coast of Africa, although by this they lengthen their voyage; for when they have come within the range of the trade-winds, they are sure of finding a fair wind to carry them to their desired port. In the Indian ocean the trade-winds blow regularly from east to west between 30° and 10° of south latitude: but to the northward of this line, on both sides of the equator, the wind changes every six months, one half of the year blowing, in a general sense, from east to west, and the other half of the year from west to east. These changing trade-winds are called *monsoons*.

In warm climates we meet with what are called *sea and land breezes*; that is, the wind, during a certain portion of the day, blows on shore from the sea, and in the night time off shore from the land. The cause of this phenomenon is supposed to be, that the land being more heated by the sun's rays than the sea, the air upon the land is heated and rarefied; and, consequently, the cooler air from the sea crowds in to fill its place: but in the night time, when the

air

air on the land is cooled, the equilibrium is restored, and the current of air again returns to the sea.

Besides these motions of the air, by which great masses are observed to change their relative positions, there is another motion of the particles of air among themselves, or a sort of vibration by which they move forwards and backwards for some time, in proportion to the strength of the impulse at first applied. This vibration is occasioned by a stroke on such bodies as we call *sonorous*, whose parts being elastic, move forwards through a small space, and then return to their original position; but without stopping there, they move backwards nearly as far as they moved forwards, and thus continue this vibratory motion, gradually diminishing in effect until at last they come to be perfectly at rest: such a motion is observed in a weight fixed at the end of a string, and suspended from the finger. This vibration of the parts of a sonorous body must act upon the particles of air in contact with them, by successive, but gradually diminishing impulses, and thus by agitating the membrane called the tympanum, or drum of the ear, occasion in us that sensation to which we give the name of *sound*. Although these vibrations are produced in succession, yet the intervals between the vibrations are so minute as not to be perceptible, and therefore to our senses they produce only one constant uniform sound.

When these vibrations of the air strike against any fixed immoveable surface or body, they are compelled to change their course and move backwards, thus acting again on the ear, and producing a second sound, which we call an *echo*.

The nature and process of vibration of the particles of air, may easily be conceived by observing the appearances and effects produced by throwing a stone into a pond of still water. The water suddenly displaced by the stone rises up in a circular wave round it, and then sinks down into a hollow

hollow nearly as much below the surface of the pond as the top of the wave was above it: again, another wave is produced and succeeded by another hollow; and in this manner a number of concentric waves and hollows are exhibited, gradually diminishing in elevation and depression, until the force of the impulse communicated by the stone is exhausted, and the circles totally disappear; but, if the impulse has been considerable, these circles are continued to the margin of the pond, where, striking against the banks, a contrary impulse is given to the water, and a fresh series of waves and depressions is produced, returning back towards the centre of the pond, in the same manner as the echo returns to the ear, by the repercussion of the particles of air from the resisting body, by which the vibrations of the air had been interrupted.

Sounds are observed to move with an equable velocity of about 1142 feet in one second of time: but the strength or loudness of sounds vary agreeably to the state of the atmosphere. In cold dense air sounds are loudest, and in warm, thin, or rarefied air, they are weakest: when all air has been extracted from a vessel, or a vacuum is produced, no sound is perceived.

It was already observed, that the atmosphere is necessary for the transmission of light, which is composed of inconceivably minute particles, proceeding in straight lines, and in all directions, from certain bodies, which are thence said to be luminous, such as the sun and other celestial bodies, a fire, a candle, or any other substance in a state of combustion or burning, from heat in a certain temperature, as red hot iron; when a flint is struck against another flint, or against a steel, luminous sparks are produced.

Light is so generally found united with heat, that we are apt to consider then as inseparable; but light is frequently perceived when there is no sensible heat, as in the appearance of putrescent animal and vegetable substances, of glow-

worms

worms and other insects, of the sea when moved by the dashing of the oar, or when it breaks in waves along the beach. Light without heat is also, in certain circumstances, emitted from the diamond.

The motion of light is prodigiously rapid, being calculated at nearly 200,000 miles in one second of time.

When a ray of light passes through a substance of one uniform density, as through a pane of smooth glass, or when it passes perpendicularly from one medium to another, it moves forward in the same direction as before it touched the medium; but when a ray passes obliquely from one medium to another of a different density, it is turned aside from its former direction, and is then said to be *refracted;* and when a ray of light falls on an opposing body which it cannot penetrate, it is thrown back, and is hence said to be *reflected;* the reflected ray always forming, with the surface of the reflecting body, an angle equal to that formed with the same body, by the original impinging ray; or, in other words, the angle of reflection is always equal to the angle of incidence. Thus, if the original ray fall perpendicularly on the reflecting body, the reflected ray will return in a perpendicular direction to the object from which the original ray proceeded: but, if the original ray fall on the reflecting body at any angle, as 45 degrees, the reflected ray will fly off at an equal angle of 45 degrees from the opposite part of the reflecting body. The truth of these observations may easily be ascertained by a person observing his face in a mirror; for if he look perpendicularly at the glass he will see his face reflected, but if he stand on one side, and look obliquely at the glass, he no longer observes his figure, which, however, will be perceived by another person looking at the glass with an angle of equal obliquity, in an opposite direction. When a boy drops his marble on a level stone, it rises perpendicularly towards his hand: but if he throw it with any inclination against the stone, the marble flies off in

in an opposite direction, making the angle of reflection equal to the angle of incidence.

When rays of light proceed in all directions from a luminous body, they are said to *diverge;* and when, as by a concave mirror, they are collected together at one point, they are said to *converge*; and that point is called the *focus*, where are assembled the whole particles of light and heat reflected from the concave surface of the mirror, which, from this circumstance, is commonly called a *burning glass*.

From observing the effects produced on the rays of light, by their transmission through a medium whose opposite surfaces are convex, or portions of spheres swelling outwards, common spectacles and telescopes have been constructed; some of these last possessing the power of enlarging the images of distant objects to a very high degree.

Although light appears in general white, yet it is composed of rays of various colours, as red, orange, yellow, green, blue, purple, and violet, as may be observed by transmitting a ray of the sun's light into a dark room, through a prism of pure glass; for the different parts of rays being susceptible of different degrees of refraction, these parts will be separated in passing through the prism, and exhibit on a sheet of paper the colours peculiar to each part of the white ray. It is by the refraction of the sun's rays in passing through the minute globules of which vapours and clouds consist, that the beautiful arch in the heavens, to which we give the name of the *rainbow*, is produced.

It was before noticed, that light and heat are by no means inseparable: heat is a substance by whose action fluids are converted into vapour, and solids are either converted into vapour, rendered fluid, changed into glass, or undergo other processes observable in a state of combustion. By light we acquire the sensation of vision; by heat, that of warmth, or of heat itself. By heat bodies are expanded or enlarged;

 and

and hence we have the instrument called the *thermometer*, for measuring the quantities of heat existing in bodies, agreeably to the import of the Greek words composing the name; in the same way as the instrument for measuring the relative weights of the air is called a *barometer*.

The sensation of heat is produced in our body by particles of heat entering it; and the sensation of cold is excited by such particles passing out of the body. Heat seems to be the chief cause of the fluidity of bodies: wax, lead, silver, &c. become fluid by the application of heat; and oil, water, even mercury itself, are rendered solid by being deprived of heat.

In general it may be observed, that the highest ranges of mountains on the surface of the earth are situated between the tropics, and that their elevation diminishes as their position approaches to the poles. The loftiest parts of the grand chain or cordillera of the Andes, in South America, lie under the equator, one of the summits, *Chimborazo*, springing up to no less a height than 20,608 English feet, while the highest mountains in North America do not exceed 4000 feet.

The following Table shows the height of some of the most remarkable mountains in the world, whose elevation has yet been accurately ascertained. The second column gives the elevation as determined by means of the barometer; the third column, that discovered by geometrical operations: and when the methods by which the measurements were performed are unknown, the results are entered in the fourth column.

TABLE.

TABLE.

Mountains.	Height by Barometer.	Height by Geometry.	Method unknown.
In England,	Eng. Feet.	Eng. Feet.	Eng. Feet.
Whirnside (Yorkshire)	4,052	—	—
Ingleborough - -	3,987	—	—
Pennygent - -	3,930	—	—
Crossfell - -	—	—	3,839
Skiddaw - -	3,380	3,530	—
Snowdon (Wales) -	3,456	—	—
Mount Battock -	—	—	3,465
Pendlehill - -	3,411	—	—
Helvellyn - -	3,324	—	—
In Scotland, - -			
Ben Nevis (the highest in Britain)	4,387	—	—
Ben Lawers -	—	—	4,015
Ben More -	—	—	3,903
Schehallien -	—	—	3,564
Hartfill -	3,300	—	—
Ben Wevis - -	—	—	3,700
Ben Lomond - -	3,240	—	—
Ben Ledy - -	—	—	3,099
Arthur's Seat (Edinburgh)	—	814	—
In Ireland, - -			
Slieve Donard - -	3,150	—	—
Cruagh Patrick -	2,666	—	—
Nephin - - -	2,640	—	—
Knock Meledown -	2,700	—	—
Mangerton -	—	2,500	—
Cumeragh -	2,160	—	—
In the Isle of Mann,			
Snafield - -	—	—	1,640
In France,			
Puy de Sansy -	—	—	6,300
Plomb de Cantal -	—	—	6,200
Puy de Dome -	—	—	5,000

In the Pyrenees,			
Mont Perdu	11,000	—	—
Canigou -	9,000	—	—
In the Alps,			
Mont Blanc -	15,662	—	—
Mont Rosa -	—	15,084	—
Schreckhorn - -	—	—	13,000
Finsteraar - -	—	—	12,000
Mont Titlis -	—	—	10,818
Mont Cenis -	—	—	9,760
Do. at Post-house -	6,261	—	—
Mont Viso -	9,997	—	—
Grand St.Bernard, at the Convent	8,074	—	—
St. Gothard -	6,790	—	—
In Italy,			
Monte Velino (in the Appenines)	8,397	—	—
Mount Vesuvius -	3,938	—	—
Mount Somma -	3,738	—	—
Etna (Sicily) -	{ 10,954 / 10,700	—	—
In the Tyrol,			
Glochner -	—	—	12,130
Ortele -	—	—	13 800
Plaley Kogel -	—	—	10,390
In Germany,			
Lomnitz, in the Carpathian mountains	—	—	8,640
Brenner - -	—	—	5,109
Stuben - -	—	—	4,692
In Norway and Sweden,			
Swukku -	—	—	9,000
Areskutan -	—	—	6,162
Rætack -	—	—	6,000
Hecla (Iceland)	—	—	5,000
In Russia,			
Pauda - -	—	4,512	—
In the Canary Islands,			
Peak of Teneriffe	15,396	—	11,424

In

In North America,			
White mountains -	—	—	4,000
Stony mountains -	—	—	3 000
Blue mountains	—	—	2,000
In Jamaica, -			
Blue mountains -	—	—	7,431
In South America,			
Chimborazo	20,608 20,910	20,280	—
Corazon -	15,808	—	—
Cotopaxi -	—	18,600	—
Tunguragas -	16,170	—	—
Pichincha -	15,552	—	—

The sea or ocean covers about two thirds of the surface of the globe; but the quantity of water it contains will perhaps never be ascertained, from our ignorance of its various depths. The greatest depth which has ever been measured is 5,346 feet, or a little more than an English mile; and its mean depth has been calculated at about 1,300 feet, or a quarter of a mile. At great distances from the land the depth of the sea increases or diminishes with some regularity, but near the shore it varies very considerably; bearing, however such a relation to the land, that along a high steep shore the water deepens very rapidly, while before a low flat beach, it deepens very slowly for a good way out.

If the whole inhabited parts of the earth be supposed to contain 38,990,569 square miles, Europe will contain 4,456,065, Asia 10,768,823, Africa 9,654,807, and America 14,110,874: and if the whole population be estimated at 700,500,000 persons, Europe will possess about 150,000,000; Asia, including the great country of New Holland and the isles in the Pacific Ocean, 500,500,000; Africa 30,000,000, and America 20,000,000: so that the population on a square mile, at an average, will be in Europe 34, in Asia 46, in Africa 3, and in America 1½, or 3 for every 2 square miles.

Before

Before entering on the description of the several quarters of the globe, it will be convenient for the student to possess the following table of the latitude and longitude of some of the most remarkable towns, capes, &c. collected from the latest and most accurate observations.

In this table the longitude is reckoned not from the meridian of London, but from that of the observatory erected on the summit of the hill in Greenwich Park, which being the station of the Astronomer Royal, (at present the eminent *Dr. Nevil Maskelyne*,) where a regular system of celestial observation is carried on, and to which all calculations relating to geography, navigation, and astronomy are referred, it has for a considerable time been determined, that the first meridian should be that which passes over this observatory.

The difference of longitude between the observations of Greenwich and Paris having been carefully ascertained to be 2°, 19′, 51″, the student will have no difficulty in reducing longitudes calculated for the meridian of Paris, as in the French maps and sea-charts, to the meridian of Greenwich, and *vice versa;* for Paris being situated 2°, 19′, 51′ to the eastward of Greenwich, if the longitude be given east from Paris, the above difference must be added to obtain the longitude from Greenwich; but if the given longitude be west from Paris, this difference must be subtracted: thus, if Rome be situated in longitude east from Paris 30°, 7′, 40″, by adding the difference we have 32°, 27′, 31″ for the longitude of Rome east from Greenwich; again, if the Royal Marine Observatory in Cadiz be situated in longitude west from Paris 8°, 37′, 35″, by subtracting the above difference we have 6°, 17′, 44″ for the longitude of Cadiz west from Greenwich. By means of this difference of longitude between Greenwich and Cadiz, all longitudes reckoned from this last place, as is done in the modern Spanish maps and charts, may, in a similar way, be reduced to the meridian of Greenwich.

TABLE

TABLE

Of the Latitude and the Longitude from the Meridian of Greenwich Observatory of some of the most remarkable Places on the Globe.

Places.	Countries or Seas.	Latitudes.				Longitudes.			
Abbeville	France	50°	7′	4″	N.	1°	49′	43″	E.
Aberdeen	Scotland	57	9	0	—	2	8	0	W.
Abo	Finland	60	27	7	—	22	15	0	E.
Acapulco	Mexico	17	0	5	—	101	59	30	W.
Aden	Arabia	12	40	0	—	46	13	0	E.
Adrianople	Turkey	42	0	0	—	26	25	0	—
Agra	India	27	12	0	—	78	18	0	—
Aix	France	43	31	48	—	5	26	34	—
Aleppo	Syria	36	11	25	—	37	10	0	—
Alexandretta or Scanderoon	Syria	36	34	47	—	36	15	0	—
Alexandria	Egypt	31	13	5	—	29	55	30	—
Algier	Barbary	36	48	30	—	3	3	0	—
Alicant	Spain	38	28	30	—	0	28	50	W.
Amiens	France	49	53	43	—	2	17	56	E.
Amsterdam	Holland	52	21	56	—	4	50	30	—
Ancona	Italy	43	37	54	—	13	28	52	—
Andrews (St.)	Scotland	56	19	33	—	2	50	30	W.
Antibes	France	43	34	43	—	7	7	20	E.
Antigua	Caribbee Isls.	17	4	30	—	62	9	0	W.
Antioch	Syria	36	19	45	—	36	30	45	E.
Antwerp	Netherlands	51	13	18	—	4	24	0	—
Archangel	Russia	64	34	0	—	38	59	0	—
Arcot	India	12	51	24	—	79	28	4	—
Ascension Isl.	Atlantic	7	57	0	S.	13	59	30	W.
Astracan	Tartary	46	21	12	N.	48	2	45	E.
Athens	Greece	38	5	0	—	23	52	36	—
Autun	France	46	56	48	—	4	17	44	—
Augsburg	Germany	48	21	42	—	10	53	38	—
Avignon	France	43	57	0	—	4	48	10	—
Awatska-bay	Kamtschatka	52	51	42	—	158	48	0	—

Babel-

Babelmandel	Red Sea	12	50	0	N.	43	45	0	E.
Bagdat	Arabia	33	20	0	—	44	22	15	—
Ballasore	India	21	20	0	—	86	1	30	—
Bridgetown	Barbadoes	13	5	0	—	59	40	15	W.
Barbuda Island	Atlantic	17	49	45	—	61	50	0	—
Barcelona	Spain	41	23	8	—	2	10	25	E.
Barfleur	France	49	40	21	—	1	15	56	W.
Basil	Switzerland	47	33	34	—	7	35	0	E.
Bassora	Persian Gulf	30	24	0	—	43	38	54	—
Bastia	Corsica	42	41	36	—	9	26	30	—
Batavia	Java	6	11	0	—	106	50	0	—
Bath	England	51	22	30	—	2	21	30	W.
Bayonne	France	43	29	15	—	1	28	41	—
Belfast	Ireland	54	40	0	—	6	8	0	—
Belgrade	Hungary	44	53	18	—	20	30	0	E.
Belle-isle	France	47	17	17	—	3	5	0	W.
Benares	India	25	20	0	—	83	10	0	E.
Bencoolen	Sumatra	3	49	16	S.	102	2	30	—
Bergen	Norway	60	23	40	N.	5	11	30	—
Berlin	Prussia	52	31	30	—	13	23	0	—
Bermudas Isl.	Atlantic	32	35	0	—	63	28	0	W.
Berne	Switzerland	46	57	0	—	7	26	0	E.
Berwick	Britain	55	47	30	—	2	0	0	W.
Besançon	France	47	14	12	—	6	2	46	E.
Blanco (Cape)	Africa	20	55	30	—	17	10	0	W.
Bologna	Italy	44	29	36	—	11	20	25	E.
Bombay	India	18	55	42	—	72	54	24	—
Boston	New England	42	25	0	—	70	37	15	W.
Botany Bay	New Holland	34	6	0	S.	151	15	0	E.
Boulogne	France	50	43	37	N	1	36	33	—
Bourdeaux	France	44	50	14	—	0	34	15	W.
Bourges	France	47	4	58	—	2	23	46	E.
Bremen	Germany	53	4	45	—	8	47	48	—
Breslau	Silesia	51	6	30	—	17	35	30	—
Brest	France	48	22	42	—	4	29	59	W.
Bristol	England	51	28	0	—	2	35	0	—
Brunswick	Germany	52	15	43	—	10	29	15	E.
Brussels	Netherlands	50	50	59	—	4	21	55	—
Buda	Hungary	47	29	44	—	19	1	45	—
Buenos Ayres	South America	34	35	26	S.	58	23	38	W.
Cadiz	Spain	36	31	0	N.	6	17	35	W.
Cairo	Egypt	30	2	21	—	31	18	30	E.
Calais	France	50	57	31	—	1	51	1	—
Calcutta at Fort William	Bengal	22	34	45	—	88	29	30	—
Calicut	India	11	18	0	—	75	43	0	—
Calmar	Sweden	56	40	30	—	16	26	0	—

Cambray

Cambray	France	50	10	35	N.	3	13	31	—
Cambridge	England	52	12	36	—	0	4	15	—
Canterbury	England	51	18	26	—	1	4	33	
Canton	China	23	8	9	—	113	16	17	—
Carthagena	Spain	37	35	50	—	1	1	35	W.
Carthagena	South America	10	26	35	—	75	20	35	—
Cassel	Germany	51	19	20	—	9	35	0	E
Chandernagore	Bengal	22	51	26	—	88	29	15	—
Charlestown	Carolina	32	45	0	—	80	10	0	W
Cherburg	France	49	38	26	—	1	37	18	—
Christiana	Norway	59	55	20	—	10	49	0	E.
Christopher, St	Caribbees	17	15	0	—	62	42	20	W.
Cape Clear	Ireland	51	19	0	—	9	23	15	—
Cochin	India	9	58	0	—	76	15	0	E.
Cologne	Germany	50	55	21	—	6	55	0	—
Comorin, Cape	India	8	4	0	—	77	33	50	—
Constantinople	Turkey	41	1	10	—	28	55	5	—
Copenhagen	Denmark	55	41	5	—	12	35	10	—
Cordova	Spain	37	52	0	—	4	15	0	W.
Cork	Ireland	51	53	54	—	8	28	15	—
Corvo	Azores Isl.	39	43	0	—	31	6	0	—
Cowes	Isle of Wight	50	46	0	—	1	20	0	—
Cracow	Poland	50	4	0	—	19	56	0	E.
Cremona	Italy	45	7	49	—	10	2	0	—
Cromarty	Scotland	57	43	0	—	4	9	0	W.
Cruz Santa	West Indies	17	49	0	—	64	53	0	—
Cuba, E. point	West Indies	20	5	0	—	74	15	0	—
Damascus	Syria	33	15	0	—	37	2	30	E
Damietta	Egypt	31	25	41	—	31	49	45	—
Dantzic	Prussia	54	21	5	—	18	38	45	—
Dartmouth	England	50	21	0	—	3	42	0	W.
David's St. head	Wales	51	56	0	—	5	26	0	—
Dieppe	France	49	55	0	—	1	4	0	E.
Dominica Isl.	Caribbees	15	18	0	—	61	28	0	W.
Dorchester	England	50	42	0	—	2	26	0	—
Douglas	Isle of Man	54	7	0	—	4	38	0	—
Dover Castle	England	51	7	48	—	1	19	7	E.
Dresden	Saxony	51	2	54	—	13	36	0	—
Dronthein	Norway	63	26	12	—	10	22	0	—
Dublin	Ireland	53	21	11	—	6	6	30	W.
Dunbar	Scotland	56	1	0	—	2	33	0	—
Dundee	Scotland	56	27	0	—	3	2	30	—
Duncansby, or Dungesbay Head	Scotland	58	40	0	—	3	7	0	—
Dunkirk	France	51	2	11	—	2	19	51	.
Dunnose	Isle of Wight	50	37	7	—	1	11	36	W.
Durham	England	54	43	45	—	1	15	0	—

Eddystone lighthouse	England	50	10	55	N.	4	15	3	W.
Edinburgh College	Scotland	55	57	5	—	3	12	10	--
Elsineur	Denmark	56	2	15	—	12	37	48	E.
Embden	Germany	53	12	0	—	7	16	0	—
Ephesus	Asia	37	55	0	—	27	30	0	—
Exeter	England	50	54	0	—	3	34	30	W.
Falmouth	England	50	8	0	—	5	2	0	—
Fayal Town	Azores	38	32	34	—	28	40	54	—
Ferrara	Italy	44	50	0	—	11	36	10	E.
Ferro Town and Isle	Canaries	27	47	0	—	17	45	50	W.
Fez	Morocco	33	32	5	—	4	55	7	—
Fifeness	Scotland	56	17	0	—	2	37	0	—
Finisterre, Cape	Spain	42	53	52	—	9	12	54	—
Florence	Italy	43	46	30	—	11	3	30	E.
Flushing	Holland	51	26	37	—	3	34	9	—
Foreland North	England	51	25	0	—	1	28	0	—
Foreland South	England	51	8	26	—	1	22	6	—
Fort Royal	Martinico	14	16	0	—	61	7	18	W.
Funchal	Madeira	32	37	34	—	17	6	0	—
Gaeta	Italy	41	14	2	—	13	30	5	E.
Galway	Ireland	53	10	0	—	10	1	0	W
Geneva	Switzerland	46	12	17	—	6	8	30	E.
Genoa	Italy	44	25	0	—	8	56	0	—
Gibraltar, Europa Point	Spain	36	6	30	—	5	19	31	W.
Glasgow	Scotland	55	51	32	—	4	16	0	—
Goa	India	15	31	0	—	73	45	0	E.
Good Hope, Cape	Africa	34	29	0	S.	18	23	7	—
Goree, Island	Africa	14	40	0	N.	17	25	0	W.
Gottenburg	Sweden	57	42	0	—	11	39	0	E.
Greenwich Observatory	England, 1st meridian	51	28	40	—	0	0	0	—
Grenada, at Port Royal	Caribbees	12	2	54	—	61	51	15	W.
Guernsey	English Channel	49	30	0	—	2	52	0	—
Hague	Holland	52	3	13	—	4	16	25	E.
Halifax	Nova Scotia	44	46	0	—	63	27	0	W.
Hamburgh	Germany	53	34	0	—	9	55	0	E.
Hanover	Germany	52	22	18	—	9	44	15	—

Harwich

Harwich	England	52	11	0	N.	1	13	0	E.
Havannah	Cuba	23	11	54	—	82	8	36	W
Havre de Grace	France	49	29	14	—	0	6	23	E.
Helena, St. James Town	Atlantic	15	55	0	S.	5	49	0	W.
Hogue, Cape la	France	49	44	40	N.	1	56	30	—
Holy Head	Anglesey	53	23	0	—	4	45	0	—
Horn, Cape	South America	55	58	30	S.	67	26	0	—
Hall	England	53	38	0	N.	0	33	0	—
Jackson, Port	New Holland	33	52	30	S.	151	19	0	E.
Janeiro, Rio	Brazil	22	54	10	—	42	44	0	W.
Jersey, St. Helier	English Channel	49	12	59	N.	2	10	59	—
Jerusalem	Palestine	31	46	0	—	35	20	0	E.
Inverness	Scotland	57	36	0	—	4	15	0	W.
John's, St.	Newfoundland	47	32	0	—	52	26	0	—
Ispahan	Persia	32	24	34	—	51	50	0	E.
Julian, St. Port	South America	49	10	0	S	67	44	0	W.
Kingston	Jamaica	18	6	0	N.	76	45	0	—
Kinnaird Head	Scotland	57	42	0	—	2	0	0	—
Kinsale	Ireland	51	32	0	—	8	50	0	—
Kiov	Russia	50	27	10	—	30	27	30	E.
Kirkcaldy	Scotland	56	8	0	—	3	10	0	W.
Koningsberg	Prussia	54	42	10	—	20	29	0	E.
Land's End	England	50	4	7	—	5	42	0	W.
Lausanne	Switzerland	46	31	6	—	6	45	15	E.
Leeds	England	53	48	0	—	1	38	30	W.
Leghorn	Italy	43	33	2	—	10	16	0	E.
Leith	Scotland	56	0	0	—	3	11	0	W.
Leipsic	Germany	51	22	22	—	12	20	30	E.
Lerwick	Shetland Isles	60	13	0	—	0	55	0	W.
Liege	France	50	39	22	—	5	31	27	E.
Lille	France	50	37	0	—	3	4	0	—
Lima	South America	12	1	56	—	76	54	0	W.
Limerick	Ireland	52	22	0	—	9	53	0	—
Lincoln	England	53	15	0	—	0	30	0	—
Lisbon Observatory	Portugal	38	42	20	—	9	9	15	—
Liverpool	England	53	24	0	—	3	10	0	—
Lizard flagstaff	England	49	57	56	—	5	11	18	—
London, St. Paul's	England	51	30	49	—	0	5	47	—
Londonderry	Ireland	54	59	28	—	7	14	49	—
L' Orient, Port	France	47	45	11	—	3	21	17	—
Lucia, St.	Caribbees	13	24	30	—	60	51	0	—

Lyon	France	45	45	52	N.	4	49	9	E.
Macao	China	22	13	0	—	113	35	0	—
Madras	India	13	4	54	—	80	28	0	—
Madrid	Spain	40	25	18	—	3	12	0	W.
Mahon, Port	Minorca	39	51	46	—	3	48	30	E.
Malaga, Mole	Spain	36	43	30	—	4	25	0	W.
Malo, St.	France	48	39	0	—	2	1	22	—
Malta	Mediterranean	35	54	0	—	14	28	0	E.
Manchester	England	53	26	0	—	2	15	0	W.
Marseilles	France	43	17	45	—	5	22	8	E.
Mecca	Arabia	21	40	12	—	40	9	0	—
Messina	Sicily	38	11	12	—	15	48	48	—
Mexico	N. America	19	25	50	—	100	5	45	W.
Middleburg	Holland	51	30	6	—	3	37	35	E.
Milan Observ.	Italy	45	28	5	—	9	11	15	—
Montserrat	West Indies	16	47	0	—	62	17	0	W.
Montevideo	South America	34	54	48	S.	56	14	45	—
Montpellier	France	43	27	0	N.	3	53	0	E.
Montrose	Scotland	56	42	0	—	2	28	0	W.
Moscow	Russia	55	45	45	—	37	32	45	E.
Munich	Bavaria	48	9	55	—	11	30	0	—
Nancy	France	48	41	55	—	6	10	16	—
Nankin	China	32	4	40	—	118	47	0	—
Nantes	France	47	13	6	—	1	32	59	W.
Naples	Italy	40	50	15	—	14	17	30	E.
Newcastle (Tyne)	England	55	3	0	—	1	30	0	W.
Nice	Italy	43	41	46	—	7	16	21	E.
Norfolk Island	Pacific ocean	29	1	45	S.	168	10	0	—
North Cape	Lapland	71	10	30	N.	25	57	0	—
Norwich	England	52	41	30	—	1	20	0	—
Nuremberg	Germany	49	26	55	—	11	0	45	—
Omer's, St.	France	50	44	46	—	2	14	57	—
Oporto	Portugal	41	10	0	—	8	27	0	W.
Orleans	France	47	54	10	—	1	54	27	E.
Ortegal, Cape	Spain	43	46	37	—	7	39	0	W.
Ostend	France	51	13	55	—	2	55	45	E.
Owyhee, S. point	Sandwich Isls.	18	54	0	—	155	45	0	—
Oxford Observ.	England	51	45	39	—	1	15	29	W.
Padua	Italy	45	23	40	—	11	52	30	E.
Palermo	Sicily	38	6	45	—	8	41	30	—
Palma	Canaries	28	38	0	—	17	50	0	W.
Panama	S. America	8	47	48	—	80	21	0	—
Paris Observ.	France	48	50	15	—	2	19	51	E.

Parma

Parma	Italy	44	48	0	N.	10	20	19	E.
Passau	Bavaria	48	36	3	—	13	25	7	—
Pekin	China	39	54	13	—	116	27	30	—
Perpignan	France	42	42	3	—	2	53	35	—
Perth	Scotland	56	23	40	—	3	27	10	W.
Petersburg	Russia	59	56	23	—	30	19	15	E
Philadelphia	North America	39	56	55	—	75	14	0	W.
Pisa	Italy	43	43	7	—	10	23	0	E.
Plymouth garrison	England	50	21	22	—	4	7	24	W.
Pondicherry	India	11	41	55	—	79	42	55	E.
Portsmouth Observatory	England	50	48	3	—	1	5	59	W.
Prague	Bohemia	50	5	47	—	14	24	0	E.
Presburg	Hungary	48	8	0	—	17	10	30	—
Quebec	North America	46	47	30	—	71	10	0	W
Quimper	France	47	58	29	—	4	7	0	—
Quito	South America	0	13	27	S.	77	55	0	—
Rame Head	England	50	18	52	N.	4	12	29	
Ramsay	Isle of Mann	54	17	0	—	4	26	0	—
Ratisbon	Germany	48	59	51	—	12	6	30	E.
Ravenna	Italy	44	25	5	—	12	10	36	—
Rheims	France	49	15	16	—	4	1	48	—
Rhodes Island	Mediterranean	36	28	30	—	28	45	0	—
Riga	Russia	57	5	0	—	25	5	0	—
Rochelle	France	46	9	21	—	1	9	55	W.
Rome, at St. Peter's	Italy	41	53	54	—	12	29	15	E.
Rosetta	Egypt	31	24	34	—	30	28	36	—
Rothesay	Scotland	55	50	0	—	5	17	0	W.
Rotterdam	Holland	51	55	58	—	4	28	0	E.
Rouen	France	49	26	27	—	1	5	44	W.
Sable, Cape	Nova Scotia	43	23	45	—	65	39	15	—
Salisbury Cathedral	England	51	3	49	—	1	47	0	—
Salonica	Turkey	40	41	10	—	23	8	0	E.
Salzburg	Germany	47	43	6	—	12	59	8	—
Santa Cruz	Teneriffe	28	27	30	—	16	16	15	W.
Scarborough	England	54	21	0	—	0	18	0	—
Scaw light	Denmark	57	44	0	—	10	37	45	E.
Scilly, St. Agnes' light-house	England	49	53	37	—	6	19	23	W.
Seringapatam	India	12	31	45	—	76	46	40	E.
Seville	Spain	37	23	0	—	5	25	0	W
Sierra Leone, Cape	Africa	8	29	30	—	13	9	17	—

Sligo

Sligo	Ireland	54	15	0	N	8	49	0	W.
Smyrna	Asia	38	28	0	—	27	20	0	E.
SnœsellMount	Iceland	64	52	20	—	23	54	0	W.
Southampton	England	50	54	0	—	1	23	56	—
Spartel, Cape or Espartel	Africa	35	48	40	—	5	54	10	—
Spurn Point	England	53	41	0	—	0	17	0	E.
Start Point	England	50	13	26	—	3	38	21	W.
Stockholm	Sweden	59	20	31	—	18	3	35	E
Strasburg	France	48	34	45	—	7	44	36	—
Stutgard	Germany	48	46	16	—	9	10	36	—
Surat	India	21	11	0	—	72	22	30	—
Syracuse	Sicily	37	3	0	—	15	27	3	—
Tangier	Africa	35	47	0	—	5	47	0	W.
Tarragona	Spain	41	8	50	—	1	19	15	E.
Teneriffe Peak	Canaries	28	17	0	—	16	38	0	W.
Texel	Holland	53	10	0	—	4	59	0	E.
Tobago	Caribbees	11	7	0	—	60	40	0	W.
Toledo	Spain	39	50	0	—	3	19	58	—
Torbay, at Bury Head	England	50	24	1	—	3	28	14	—
Tornea	Sweden	65	50	50	—	24	14	0	E.
Toulon	France	43	7	16	—	5	56	0	—
Tours	France	47	23	46	—	0	41	32	—
Treves	France	49	46	41	—	6	38	3	—
Trieste	Istria	45	51	0	—	14	3	0	—
Trincomalee	Ceylon	8	32	0	—	81	12	0	—
Tripoli	Africa	32	53	40	—	13	5	0	—
Tunis	Africa	36	45	30	—	5	33	6	—
Turin	Italy	45	4	14	—	7	40	0	—
Upsal	Sweden	59	51	50	—	17	38	40	—
Uraniburg Observatory	Denmark	55	54	38	—	12	42	44	—
Utrecht	Holland	52	5	0	—	5	6	48	—
Ushant Isle	France	48	28	30	—	5	4	48	W.
Valencia	Spain	39	26	0	—	0	17	0	—
Venice	Italy	45	26	7	—	12	3	15	E.
Venus Poin	Otaheite	17	29	17	S.	149	35	45	W.
Vera Cruz	Mexico	19	11	52	N.	96	1	45	—
Verd, Cape	Africa	14	45	0	—	17	33	0	—
Verona	Italy	45	26	26	—	11	18	30	E.
ViennaObserv.	Germany	48	12	36	—	16	16	22	—
Vigo	Spain	42	14	24	—	8	28	0	W.
Vincent, St. Cape	Portugal	37	2	54	—	8	59	26	—

Wardhus

EUROPE.
NORTHERN OCEAN
ATLANTIC OCEAN
BRITISH ISLES
NORTH SEA
BALTIC
BAY OF BISCAY
MEDITERRANEAN SEA
BLACK SEA
CASPIAN SEA
ASIA MINOR
AFRICA
ARCHIPELAGO
GULF OF VENICE
GULF OF BOTHNIA
G. OF FINLAND
WHITE SEA
SEA OF AZOF
BRITISH CHANNEL
Artic Circle
Ural Mountains
ICELAND
Ferro Isles
Shetland Isles
Orkney Isles
Western Isles
NORWAY
SWEDEN
FINLAND
DENMARK
PRUSSIA
POLAND
GERMANY
FRANCE
SPAIN
PORTUGAL
ITALY
HUNGARY
TURKEY
GREECE
RUSSIA
LAPLAND
SWITZERLAND
NETHERLANDS
CORSICA
SARDINIA
SICILY
CRIMEA
Candia
Cyprus
Malta
Majorca
Minorca
LONDON
PARIS
MADRID
LISBON
ROME
NAPLES
VIENNA
BERLIN
WARSAW
STOCKHOLM
COPENHAGEN
S.T PETERSBURG
MOSCOW
CONSTANTINOPLE
Edinburg
Dublin
Amsterdam
Brussels
Hamburg
Dantzig
Cracow
Presburg
Buda
Venice
Genoa
Florence
Barcelona
Valencia
Cadiz
Gibralter
Strait of Gibralter
Algiers
Tunis
Oran
Belgrade
Athens
Smyrna
Astrachan
Orenburg
Archangel
Kazan
Meridian 0 of London
East Longitude

Wardhus	Lapland	70	22	36	N.	31	6	45	E.
Wakefield	England	53	41	0	—	1	33	30	W.
Warsaw	Poland	52	14	28	—	20	59	54	E.
Weimar	Germany	50	59	12	—	11	20	45	—
Weymouth	England	50	40	0	—	2	34	0	W.
Whitby	England	54	29	0	—	0	53	0	—
Whitehaven	England	54	25	0	—	3	15	0	—
Worcester	England	52	9	30	—	1	59	15	—
Wirtzburg	Germany	49	46	6	—	10	21	45	E.
Yarmouth church, Norfolk	England	52	36	40	—	1	44	22	—
York	England	53	57	45	—	1	6	45	W
York, New	North America	40	43	0	—	74	10	0	—
Zant Town	Zant Island	37	48	0	—	21	20	0	E.
ZealandNew N. cape	Pacific Ocean	34	22	0	S.	172	35	0	—
S. cape		47	17	0	—	167	20	9	—
Zurich	Switzerland	47	22	0	N	8	32	35	—

EUROPE.

THIS quarter, or portion of the globe, is situated wholely on the north side of the equator, between the parallel of latitude 35°, which includes Gibraltar with the islands of Malta and Candia, and the parallel of 72°, comprehending the north cape in Lapland, the most advanced point of the continent of Europe, towards the north poles. The extent in longitude is from 11° west from Greenwich, inclosing Ireland, to 62° east from the same meridian, to the boundary of Asia. The distance from north to south, between the north cape and the island of Candia, is about 2,100 geographic, or 2,420 English miles; and from Cape St. Vincent in Portugal, in a north-easterly direction to the northern confines of Asia, is a stretch of about 2,850 geographic, or 3,290 English miles.

Within

Within the limits here assigned to Europe, are comprised tracts of sea so extensive, that, upon an average of various computations, the whole land is not supposed greatly to exceed two million and one half of square miles; but sundry islands belonging to Europe are not taken into this calculation, such as the Azores or Western Islands in the Atlantic, Iceland, Spitzbergen, Nova Zembla, &c.

Europe is bounded by the sea on three sides; on the north by the Arctic, or Frozen ocean, on the west by the Atlantic, and on the south by the Mediterranean sea: the eastern boundary separating it from Asia, is formed by an imaginary line proceeding from the island of Candia, up the middle of the Archipelago, through the strait of the Dardanelles, the sea of Marmora, before Constantinople, across the Black sea and sea of Asoph, to the mouth of the river Don. Up this river the boundary runs for a considerable distance, and then crosses a narrow isthmus to the river Wolga, which it follows up for many miles, and then stretches over to the great chain of Uralian mountains, running northerly along their ridge, and, from their termination, following the course of the river Cara to the shores of the Frozen ocean.

Climate and Soil.—The greater part of Europe enjoys a moderate temperature of the atmosphere; although in the southern parts of Spain, Italy, and Greece, the heat is often oppressive, while in those tracts lying along the Frozen ocean the cold is such as almost entirely to forbid all vegetation or culture: and such is the distribution of soils and climates, that from the Baltic to the Mediterranean, cattle, corn, wine, and oil, present themselves in regular and abundant succession.

Inland Seas, Bays, &c.—It is the peculiar advantage of Europe to be indented and penetrated by various arms of the sea, in such a manner that, excepting towards the Asiatic frontier of Russia, no spot can be found within its limits distant more than 450 English miles from some sea: and

to

to this peculiar advantage, in conjunction with the moderate temperature of the climate, the fertility of the soil, and the number of large and important islands, lining both its external and its internal seas, may, in a great measure, be attributed the distinguished superiority of Europe, in civilization and industry, in arts and in arms, over the other quarters of the globe.

White Sea.—The white sea, or gulf of Archangel, is a branch of the Frozen ocean, running south-westerly into the northern parts of Russia. This sea was formerly much frequented by navigators from the western and southern parts of Europe, during the summer months: but, since the establishment of Petersburgh, this commerce has greatly declined.

Baltic.—The Baltic, or as it is usually called by seamen, the East sea, penetrates from the Atlantic into the heart of the north of Europe, separating Sweden and Finland on the north from Denmark, Prussia, Poland, and Russia, on the south. This sea is divided into two branches; the one running north, called the gulf of Bothnia, separating Sweden from Finland, and the other extending eastward, called the gulf of Finland, and dividing that country from Russia: at the extremity of this gulf lies Petersburgh, the modern capital of the Russian empire.

German ocean.—The German ocean, which washes the east coasts of Britain, and the west coasts of Denmark and Holland, may be considered as a deep gulf of the Atlantic, notwithstanding it has, at this day, by the strait of Dover, and the English channel, a communication with that ocean: for from many circumstances it may not unreasonably be concluded, that the sea has not always flowed between Dover and Calais; and that, in some remote period, Britain was in that quarter united to the continent.

Bay of Biscay.—This bay is also an inlet from the Atlantic,

tic, bordered on the east by the coast of France, and on the south by that of Spain.

Gulf of Venice, &c. Within the strait of Gibraltar, along the European shore of the Mediterranean, we meet with the gulfs of Lyons and Genoa; and, at the southern point of Italy, the gulf of Taranto: but the most considerable branch of the Mediteranean is the gulf of Venice, also called the Adriatic sea, denominations drawn from two cities, the one ancient, the other more modern, situated at its northern extremity. This gulf extends in a north-westerly direction from its mouth, at the south-east spur of Italy, to the bottom between Venice and Triest, about 520 English miles, washing the shores of Italy on the one hand, and those of Albania, Dalmatia, Morlachia, and Istria, on the other. At its entrance the breadth may be about 50 miles; but, towards the middle, the distance, from shore to shore, is not less than 130 miles.

Bay of Corinth, &c.—The gulfs, or bays of Arta or Ambracia, of Lepanto or Corinth, of Coron, of Napoli, of Engia or Athens, of Salonica or Thessalonica, indent and enrich the shores of Greece.

Capes, Promontories, &c.—The most remarkable headlands of Europe are the north cape in Lapland, the Naze at the south end of Norway, Capes Finisterre, St. Vincent, De Gata, on the coasts of Spain and Portugal, Spartivento and Santa Maria, the most southerly projections of Italy, Matapan, the most advanced point of Greece in the same direction. The principal promontories of the several European islands have also their peculiar appellations, to be enumerated in their particular descriptions.

Mountains.—Europe is traversed and knit together by various ranges of mountains, of which the most considerable is that of the Alps, which separate Italy, on the east and south, from France, Switzerland, and Germany, on the west and north. Of this vast chain the most elevated point is

is *Mont Blanc*, so named from the unvarying whiteness of its mantle of snow, soaring up, according to some observers, 15,662 English feet; but, according to others, only 15,302 feet above the level of the Mediterranean sea.

Of the Pyrenees, which occupy the whole isthmus connecting Spain with France, the loftiest summit is that of *Mont Perdu*, which rises 11,000 feet above the sea.

The Appenines, which, springing from the same root with the Alps, extend the whole length of Italy, present peaks of great elevation; *Monte Velino* raising its top no less than 8,397 feet above the Mediterranean.

The Dalecarlian mountains, which divide Norway from Sweden, are likewise very lofty, the elevation of the summit of *Swucku* being estimated at about 9,000 feet.

A point in the Carpathian, or Krapak Range, extending between Poland and Hungary, has been computed to be elevated 8,640 feet above the surface of the sea.

Besides these lofty ranges, the Sierra Nevada, Sierra Morena, Sierra de Urbion in Spain, and the Jura mountains separating France from Switzerland, attain very considerable elevations above the sea.

Rivers.—The Volga, the Danube, the Nieper, the Rhine, and the other chief rivers of Europe, will be noticed in the descriptions of the countries to which they respectively belong.

Political Divisions.—Europe may be divided into the following states: 1. The united kingdom of Great Britain and Ireland; 2. Denmark and Norway, 3. Sweden, 4. Russia, 5. Holland, 6. German states, 7. Prussia, 8. Poland, 9. Austrian dominions, 10. France, 11. Switzerland, 12. Portugal, 13. Spain, 14. Italy, Corsica, Sardinia, Sicily, Malta, &c. 15 Turkish dominions.*

THE

* In this arrangement the young geographer is supposed to run over his map as he peruses the page of a book, beginning at the top, and reading from

the

I.

THE BRITISH DOMINIONS.

These dominions comprehend the islands of Britain and Ireland, with the Shetland, Orkney, and western isles of Scotland, Mann, Anglesey, Wight, and others of less note on the coasts of England and Ireland, together with Jersey, Guernsey, Alderney, &c. on the coast of France.

Situation and Extent.—Britain is situated between the parallel of the Lizard in north latitude 49°. 58′, and that of the northern extremity of Scotland in 58°, 46′, and between the meridian of Yarmouth in east longitude 1°, 44, 22″, and that of west longitude 6°, inclosing the most westerly parts of Scotland: so that the length of the island from north to south may be reckoned about 528 geographic, or

the left to the right to the bottom. A different distribution has of late been introduced into some treatises on geography, of which the object is to class the several European states according to their real consequence and comparative importance. Such an arrangement might, twenty years ago, have been susceptible of some accuracy and probable stability: but, to a similar attempt, at this day, the situation of Europe seems peculiarly unpropitious. It has, therefore, been deemed most advisable, in these pages, to retain those divisions which, from their uniform employment in history, have acquired a sort of classic establishment and authority, whilst the various political changes, to which many portions of Europe have lately been subjected, are duly recorded. When the reader meets with the ancient appellations *Flanders* and *Savoy*, *the territory of Geneva*, and *the county of Nice*, he forms correct conceptions of certain districts of Europe; whilst the modern designations of the same countries, viz. *the departments of the North and the Scheld*, of *Mont Blanc*, of *Leman*, of *the Maritime Alps*, will, for many years to come, convey but very indistinct notions of the tracts intended to be pointed out. Nay, the Parisian himself, the inventor of this new nomenclature, is suspected of no tendency to royalism, when he invites his friend to share his bottle of *Burgundy*, or *Champagne;* and to describe a stranger as a *Norman* or a *Gascon*, still recalls ideas of the characteristic qualities of his anterevolutionary predecessors, which, by designating him as a native of the departments of *the Lower Seine*, or of *the Garonne*, it would be vain to attempt to excite.

nearly

nearly 10 English miles. The breadth is very irregular, for the extent along the English channel from the Land's-end to the South Foreland, is a stretch of about 312 English miles, while at Carlisle and Newcastle, the distance, from sea to sea, is only about 70 miles; and in the middle of Scotland the breadth of the Isthmus, between the firths, of the Forth and the Clyde, is not above 25 miles.

Name. The island, according to the most ancient authorities, was named *Albion* and *Britannia*; terms, which conjecture itself, has been in vain exhausted to explain. Cæsar knew it under the name of *Britannia.* The modern appellation *Great-Britain,* instead of conveying an idea of the magnitude and importance of the country, seems not a little preposterous; for it appears to have been assumed to distinguish this noble island from a province in the north-west corner of France, to which a body of British refugees passed over in the 5th century, and which from them acquired the name of *Britannia* or *Bretagne.*

The Greeks, who probably acquired their first knowledge of these islands from the Phœnicians, called them *Cassiterides,* or the islands of Tin, in imitation of the appellation employed by those early navigators.

Britain is divided into two parts, once separate and independent states, but for these hundred years past united into one kingdom. The southern portion is called *England,* or *South Britain,* and the northern is called *Scotland* or *North Britain.*

I.

ENGLAND.

England, including Wales, is of a triangular form, being in length, on the meridian, from Berwick to St. Alban's Head, in Dorsetshire, about 360 English miles, while the

base

base along t' nglish channel as about 312. The superficial area computed at 49,450 square miles; but, agreeably to the - rns of land in the several counties, lately made to parliament, England proper contains 33,204,055 acres, and Wales 4,705,400, making in all 37,909,455 acres, equal to 59,233½ square English miles.

If the population of England and Wales, as contained in the following table, be 8,876,980 persons, the average will be about 150 for each square English, or 130 for each square geographic mile.

ALPHABETICAL TABLE

Of the Counti s of England and Wales, with the Number of Acres and Inhabitants, and the chief Town of each.

Counties.	Acres.	Inhabitants.	Chief Towns.
Bedford	307,200	63,393	Bedford
Berks	438,797	109,215	Reading
Buckingham	518,400	107,444	Buckingham
Cambridge	443,300	89,346	Cambridge
Chester	676,000	191,751	Chester
Cornwall	758,484	188,269	Launceston
Cumberland	970,240	117,230	Carlisle
Derby	720,640	161,142	Derby
Devon	1,600,000	343,001	Exeter
Dorset	775,000	115,319	Dorchester
Durham	610,000	160,361	Durham
Essex	1,240,000	226,437	Chelmsford
Gloucester	800,000	250,809	Gloucester
Hereford	781,440	89,191	Hereford
Hertford	451,000	97,577	Hertford
Huntingdon	210,000	37,568	Huntingdon
Kent	832,000	307,624	Canterbury
Lancaster	1,120,600	672,731	Lancaster
Leicester	560,000	130,081	Leicester
Lincoln	1,893,120	208,557	Lincoln
Middlesex	217,600	818,129	LONDON
Monmouth	352,000	45,582	Monmouth
Norfolk	1,094,400	273,371	Norwich
Northampton	550,000	131,757	Northampton
Northumberland	1,267,200	157,101	Newcastle

Nottingham

Nottingham	480,000	140,350	Nottingham
Oxford	450,000	109,620	Oxford
Rutland	105,000	16,356	Oakham
Salop or Shropshire	890,000	167,639	Shrewsbury
Somerset	1,000,000	273,750	Taunton
Southampton or Hampshire	1,212,000	219,656	Winchester
Stafford	780,800	239,153	Stafford
Suffolk	800,000	210,431	Ipswich
Surrey	481,947	269,043	Guildford
Sussex	933,360	159,311	Lewes
Warwick	618,000	208,190	Warwick
Westmoreland	540,160	41,617	Appleby
Wiltshire	878,000	185,107	Salisbury
Worcester	540,000	139,333	Worcester
York: North Riding	1,311,187	155,506	York
West ——	1,568,000	563,953	
East ——	819,000	139,433	
England	33,264,055	8,331,434	
North Wales. Anglesey	—	33,806	Beaumaris
Caernarvon	—	41,521	Caernarvon
Denbigh	—	60,352	Denbigh
Flint	—	39,622	Flint
Merioneth	—	29,506	Bala
Montgomery	—	49,978	Montgomery
South Wales. Brecknock	—	33,633	Brecknock
Caermarthen	—	67,317	Caermarthen
Cardigan	—	42,956	Cardigan
Glamorgan	—	71,525	Caerdiff
Pembroke	—	56,280	Pembroke
Radnor	—	19,050	Presteign
Wales	4,705,400	545,546	
Total Acres	37,909,455	8,876,980	Inhabitants

The following is a statement of some of the principal towns of England, arranged according to their population in 1800.

	Inhabitants.
London - -	864,845
Manchester - -	84,000
Liverpool - -	77,653
Birmingham - -	73,670
Bristol - - -	63,645

Leeds - - -	53,162
Sheffield - -	45,000
Plymouth, &c. - -	43,194
Norwich - -	36,854
Portsmouth, &c. - -	32,166
Bath - - -	32,000
York - - -	30,032
Hull - - -	29,516
Nottingham - -	28,861
Newcastle (Northd.)	28,366
Exeter - - -	17,398
Leicester - - -	16,953
Coventry - -	16,034
Chester - - -	15,052
Dover - - -	14,845
Yarmouth (Norfolk) - -	14,845
Shrewsbury - -	14,739
Sunderland - - -	12,412
Oxford - -	11,694
Colchester - -	11,520
Worcester - - -	11,352
Ipswich - -	11,277
Derby - - -	10,832
Carlisle - - -	10,221
Lynn - - -	10,096
Cambridge - - -	10,087
Rippon - - -	9,032
Lancaster - - -	9,030
Canterbury - -	9,000
Southampton - - -	7,913
Salisbury - - -	7,668
Gloucester - - -	7,579
Durham - - -	7,530
Lincoln - - -	7,398
Northampton - -	7,000
Hereford - - -	6,828
Winchester - -	5,826

In the year 1700 the whole population of England and Wales was estimated at 5,512,900, and in 1750 at 6,523,000; the population of London in 1700 was 674,350, and in 1750 only 676,750; proofs, even after due allowance is made for the imperfection of former numerations, of the great increase of the population of England and the capital.

Climate, Soil, &c.—The climate of England is more temperate than might be imagined from a consideration of the situation of the country, much nearer to the frigid than than to the torrid zone: being an island, Britain can receive no winds, but what have crossed the sea, which is less subject to the extremes of heat and cold, than corresponding tracts of land: hence, if the general warmth of more southerly regions of Europe are unknown, England is likewise a stranger to the intense cold by which the rivers and harbours of Holland and Denmark, countries situated in equal latitudes, are generally completely locked up.

From this insular situation is also derived the general humidity of the climate, which while it produces a variety of diseases, arising from interrupted perspiration, bestows and maintains on the vales and meadows of England, a verdure and a luxuriancy of pasturage, in few countries to be paralleled.

The mean annual temperature of the weather in London, in the nine years 1772—1780, as observed at the apartments of the Royal Society, was 51,9 degrees of Fahrenheit's thermometer, and the mean monthly temperature as below.

January	35,9 degrees
February	42,3
March	46,4
April	49,9
May	56,64
June	63,22

July

July	66,3 degrees
August	65,85
September	59,63
October	52,81
November	44,44
December	41,04

In July of the present year 1808, the heat in London was uncommonly intense: for although on the 1st. of that month the thermometer exposed to the north east stood at 53 degrees, and the mean temperature of the whole month was about 68; yet on the 12th the heat rose to 88½ deg. on the 13th to 91 deg. and on the 14th to 93 degrees, at which extraordinary height it continued nearly an hour. For some preceding years the greatest heat in summer was as follows.

In 1802	-	83° on the	3 July
1803	-	80½ -	30 August
1804	-	85 -	25 June
		84 -	3 August
1805	-	79 -	4 July
1806	-	82½ -	14 June
1807	-	83	18 July
			18 August

The soil of England, although much diversified as in a country of such extent, is in general fertile; and agriculture, in all its branches, has long been studied and improved with such ardour as to carry the corn, cattle, and other productions of England, to a very high point of perfection. For a number of years past it has, however, been requisite to import from other countries considerable quantities of grain, whilst by some strange infatuation, in England alone, without Wales, no less than 6¼ millions of acres, or about one fifth of the whole land, is considered as waste and unproductive,

ductive, although, perhaps, not more than half a million is entirely incapable of improvement.

Horticulture or gardening, especially in its ornamental branches, has been cultivated in England with more attention to the natural beauties of the various situations, than in any other country: and on the continent an *English garden* is an object of imitation amongst the most distinguished improvements of rural scenery.

Mountains.—Although England may, in general, be considered as a plain country, yet in various quarters are found hilly tracts of considerable elevation, of which the highest points have been noticed in the table of the heights of the principal mountains in the known world. Not to mention the detached eminences in the southern parts of England, a chain of high lands first appears in Derbyshire in the centre of the kingdom, and, running northwards, separating Yorkshire and Durham on the east from Lancashire, Westmoreland and Cumberland on the west, extends, with a few lower openings, to the Cheviot hills, which stretch from north-east to south-west, along the borders of Scotland.

On the other hand, Wales abounds in mountains, many of which attain very considerable heights. From Snowdon, situated towards the north-west corner of the country, the view is most extensive, commanding the plains of Cheshire, the mountainous tracts of Lancashire, &c. the islands of Anglesey and Mann, with a distant prospect of Scotland and Ireland. Plinlimmon and Penmaenmawr are also very lofty summits.

Rivers.—The principal rivers of England, omitting the Tweed, which for some miles before it falls into the sea, is the boundary with Scotland, to which country it properly belongs, are, 1. The Tyne, which, rising from different sources in Northumberland, discharges itself into the German ocean, eight miles below Newcastle. 2. The Tees,

which, separating the counties of Durham and York, is lost in the same sea near Stockton. 3. The Humber, which however is rather a large estuary, or arm of the sea, formed by the junction of many rivers, of which the chief is the Trent, which, rising in Staffordshire, flows in a north easterly course about 100 miles, before its name be sunk in that of the Humber; and, together with its sister streams from the north west, furnishes abundant channels for transporting the immense natural and artificial productions of the northern and central provinces of England. 4. The Thames takes its rise in the Cotswold-hills in Gloucestershire, whence flowing in general in an easterly direction, and visiting Oxford, Abingdon, Reading, and Windsor, meets the tide near Kingston, and, separating London from Southwark, forms a station for the prodigious commerce and shipping of the British metropolis; thence extending for 30 miles lower down, and gradually enlarging its channel, discharges itself into the German ocean. The whole course of the Thames may be about 140 miles. 5. At the spot where the Thames is lost in the sea, it is joined by the Medway, a stream which, rising in the south-east parts of Surrey, flows north-east by Tunbridge, Maidstone, and Rochester, to the great naval arsenal of Chatham, and soon after unites with the Thames at Sheerness. 6. The southern provinces of England, situated between the English channel, and the rivers Thames and Severn, are too narrow to produce streams of magnitude: but many of them are of great utility in receiving the tides, and thus affording excellent commercial havens. The Severn however, rising in the centre of Wales, describes a semicircular course by Shrewsbury, Worcester, and Gloucester; and soon after forms a noble estuary or firth, called the Bristol channel, from the city of that name, situated on the Avon, a few miles from the eastern shore of the channel. The course of the Severn is computed at about 150 miles; in which it

receives

receives a number of tributary streams, of which the Wye, proceeding from the interior of South Wales, and noted for the great rise of the tides at its embouchure, is the chief. 7. The Mersey, rising in the western borders of Yorkshire, flows south-west for no great distance, receiving sundry streams on both sides, chiefly important for their services in the transport of the vast manufactural products of Manchester and its environs. Before reaching the sea, the Mersey opens into an extensive estuary, on the northern shore, of which is seated Liverpool, the great commercial capital of that quarter of the kingdom. 8. Other rivers in the north-west corner of England are the Dee, flowing by Chester, the Ribble by Preston, the Lon by Lancaster, and the Eden by Carlisle, all discharging themselves into the Irish sea.

Lakes.—The lakes of England, which are in general called meres, are but few in number, and of small extent; but those of the northern provinces, Cumberland, Westmoreland and Lancashire, have long been visited and celebrated by the admirers of nature, on account of their romantic and picturesque beauties. The meres of Lincolnshire, Huntingdonshire, &c. are fenny inundations produced by the stagnation of the waters, in a country of singular flatness, and very little elevated above the surface of the sea.

Mineral productions.—The tin-mines of Cornwall are reckoned the richest in the world; and so noted were they, in the most ancient times, that from them did the British isles obtain the name of Cassiterides, or the Isles of Tin. Copper is also found in various parts, but chiefly in the Isle of Anglescy, in the north-west part of which is a hill called Parys mountain, where copper ore is found in such abundance, as to be procured not in the ordinary way of mining, but by cutting it out of the bed, as stone is dug from the quarry. This mine, or rather mass of copper, was discovered

discovered on the 2nd of March 1768; but from vestiges of antient mining, and other circumstances, it seems probable that it was known to, and used by the Romans, while they were masters of the country.

Lead is found in abundance in Derbyshire: and veins are discovered in the Mendip hills in Somersetshire, as also in the eastern parts of Cumberland.

Iron, at once the most useful, and the most extensively distributed of the metals, has not been denied to England, where it is not only found in vast quantities, in Shropshire, Gloucestershire, Lancashire, &c. but is transformed into an infinite variety of utensils and implements, forming one of the most important branches of the manufactures of the country.

The invaluable mineral production, coal, is likewise distributed with abundance in various quarters of the kingdom. The mines in the neighbourhood of Newsastle, Sunderland, and Whitehaven, in Yorkshire, Lancashire, Staffordshire, Gloucestershire, &c. are too well known to need being described.

Salt, of an excellent quality, is obtained from the mines, and springs of Cheshire, of which the mines of Northwich are the most remarkable; and in Worcestershire and Staffordshire other salt springs are found.

The northern and western parts of England furnish great quantities and varieties of stone for building: in the south the quarries of Portland and Purbeck have long been known and esteemed.

The principal places where water is discovered impregnated with iron, sulphur, vitriol, or other mineral substances, are Bath, Bristol, Cheltenham, Buxton, Harrowgate, Scarborough, Epsom, Tunbridge, &c.

Animals. To name the horse, the cow, the sheep, is sufficient to an English reader, who cannot be ignorant of the great and commendable efforts made of late years, in all parts

parts of the country, to improve the race of these most useful animals: and the valuable qualities of the dog have not been unregarded. The stag, the buck, the fox, the hare, and various other inferior animals, who still preserve their independence, are common: but the wolf has for many years been lost: the wild cat is still discovered in certain remote corners.

The variety of birds, from the eagle to the wren, have been counted as far as eight and forty kinds: and the bustard, the largest of all, is sometimes met with in the open plains of Wiltshire and Lincolnshire.

Of reptiles in England, although their varieties be numerous, yet the viper alone ought to be considered as venomous.

From the situation of England in the midst of the waters, the abundance of the most delicious and the most valuable fish, is great indeed. The enormous whale has occasionally appeared on our shores; but the herring, the mackarel, the cod, the haddock, and other numerous sorts, present not only an immediate supply of food, but objects of unlimited industry and commerce, hitherto too generally and unaccountably overlooked. The period is not far gone when the laborious and frugal Hollanders, whose seas nature has not enriched with such treasures, fished upon our own shores, cured what they caught with salt often procured in this kingdom, provided for a suitable profit on their expenses and exertions, and after all undersold the British fishers even in their own markets.

The salmon, the trout, the char, the eel, the perch, and other natives of the English rivers, lakes, and pools, require neither description nor enumeration.

Vegetables.—Many parts of England still retain the appellation of forests, although in some scarcely a decayed oak is now to be seen: but the forests of Windsor in Berkshire, of Sherwood in Nottinghamshire, and what is yet

named

named the new forest in Hampshire, are noble assemblages of timber and trees of the most valuable kinds.

The rich and perpetual verdure for which England is distinguished above many other countries, is chiefly produced by the moisture of the climate: while the due intermixture of dry weather and sunshine brings the crops of wheat, barley, oats, pease, and other vegetable food for man and beast, to the highest perfection.

Vines were formerly reared in many parts of England. In 1086 a vineyard of 6 acres, near Rochford in Essex, yielded 20 casks of wine. In 1156 the vale of Gloucester was renowned for its abundance of prime apples, and for its grapes from which wine was made little inferior to the wines of France; but Winchester in Hampshire was then considered as the place where the best English wine was produced; and to this day a gentleman's seat in the north-east part of that county retains the name of the Vine. In the time of Edward the Third, who died in 1377, the Earl of Lancaster possessed vineyards in the neighbourhood of Leicester. Of late years an attempt has been made to raise the vine and make wine on the southern slopes of the Isle of Wight.

It is a curious fact that, from the extreme care bestowed in England in procuring and cultivating the best sorts of various fruits, flowers, and other ornaments of the garden, many of these are carried to a state of perfection to which, even in the more favoured climates where they naturally grow, they seldom arrive.

II.

SCOTLAND.

Situation and Extent.—This portion of Britain is of too irregular a form to be compared to any known figure. It is situated between the parallel of the Mull of Galloway in north

latitude 54°, 44′, and that of the northern extremity of the island at the Dunnet-head, in latitude 58°, 40′, and between the meridian of Peterhead the most easterly point of Scotland, in longitude 1° 46′, and that of the most westerly point of Ardnamurchan in Argyleshire, in longitude 6° 10′, both west from Greenwich. The greatest extent from south to north is about 236 geographic or 272 English miles, and the greatest breadth is about 140 geographic or 162 English miles, while in the middle of the country the distance across from sea to sea is only about 25 miles.

Agreeably to the returns made to parliament in 1801, the population of Scotland amounted to 1,599,068, exclusive of that of some remote districts, which was estimated at 8,692, making in all 1,607,760 inhabitants. The whole country, including the islands, has been computed to contain about 27,794 square geographic miles, giving a population upon an average of about 58 persons to one square mile. The vast tracts of mountains with which at least one half of the country is covered, occasion this scanty population; for many parts of the low country are extremely well peopled: thus for instance, the county of Fife, which has been estimated to contain 480 square miles, possessed by the latest numeration 93,743 inhabitants, a population at the rate of above 195 persons to every square mile.

The following table contains the names of the several counties or shires into which Scotland is divided, with the number of inhabitants, and the chief town of each.

TABLE.

Counties.	Inhabitants.	Chief Towns.
Aberdeen	123,082	Aberdeen
Argyle	71,859	Inveraray
Ayr	84,306	Ayr
Banff	35,807	Banff
Berwick	30,621	Dunse
Bute	11,791	Rothesay
Caithness	22,609	Wick
Clackmannan	10,858	Clackmannan
Cromarty	3,052	Cromarty
Dumbarton	20,710	Dumbarton
Dumfries	54,597	Dumfries
Edinburgh or Mid-Lothian	122,954	EDINBURGH
Elgin or Moray	26,705	Elgin
Fife	93 743	Cupar
Forfar or Angus	99,127	Forfar
Haddington or East-Lothian	29,986	Haddington
Inverness	74,292	Inverness
Kincardine or Merns	26,349	Bervie
Kinross	6,725	Kinross
Kirkcudbright	29,211	Kirkcudbright
Lanark	146,699	Lanark
Linlithgow or West-Lothian	17,844	Linlithgow
Nairn	8,257	Nairn
Orkney and Shetland	46,824	Kirkwall and Lerwick
Peebles	8,735	Peebles
Perth	126,366	Perth
Renfrew	78,056	Renfrew
Ross	52,291	Dingwall
Roxburgh	33,682	Jedburgh
Selkirk	5,070	Selkirk
Stirling	50,825	Stirling
Sutherland	23,117	Dornoch
Wigton or Galloway	22,918	Wigton
	1,599,068	
Some remote districts estimated	8,692	
Scotland	1,607,760	

The

The following Table contains a statement of some of the principal towns in Scotland, arranged according to their population in 1801.

Edinburgh - - -	82,560
Glasgow - - -	77,385
Paisley - - -	31,179
Dundee - - -	26,084
Aberdeen - - -	17,797
Greenock - - -	17,458
Perth - - -	14,878
Dunfermline -	9,980
Falkirk - - -	8,838
Inverness - - -	8,732
Kilmarnock - - -	8,079
Montrose - - -	7,974
Dumfries - - -	7,288
Campbeltown - -	7,093
Hamilton - - -	5,908
Ayr - - -	5,492
Brechin - - -	5,466
Stirling - - -	5,256
Rothsay - -	5,231
Alloa - - -	5,214
Forfar - -	5,165
Aberbrothick - -	4,943
Lanark - -	4,692
Irvine - -	4,584
Cupar (Fife) -	4,463
Elgin - -	4,345
St. Andrews - -	4,203
Kelso - -	4,196
Haddington - -	4,049
Dunbar - -	3,951
Jedburgh - -	3,834
Linlithgow -	3,594

Banff

Banff	3,571
Kirkcaldy	3,248
Dunse	3,057
Kirkwall in Orkney isles	2,621
Lerwick in Shetland isles	1,706

The population of Scotland has been progressively increasing for many years past; thus the county of Fife already mentioned, which in 1801 possessed 93,743 inhabitants, in the year 1755 contained only 81,570, indicating an augmentation of 12,173 persons. In the same year 1755, the inhabitants of Edinburgh were computed to be 57,195, but in 1801 they amounted to 82,560, and in this year (1808) they are estimated at upwards of 90,000. Glasgow, which in 1707, when the union took place between England and Scotland, contained only 14,000 people, in 1791 contained 41,777, and in 1806 the inhabitants were computed to be 86,630, having more than doubled in fifteen years.

Climate and Soil.—The climate of Scotland is very various in different quarters; for the western part of the country is subjected to heavy and frequent rains, while the eastern parts are less exposed to humidity than the corresponding parts of England: and the winters are more remarkable for the quantity of snow than for the severity of the frost. From the length of the day in the middle of summer, which in the northern parts of Scotland is about 18 hours, the heat in the vales is often intense. The mountainous tracts have been computed to occupy one half, and even two thirds of the country: and a line drawn from the mouth of the river Clyde, bending eastwards towards Perth, and terminating at Inverness, would divide the kingdom into two grand portions, the highlands on the west and north, and the lowlands on the south and east. The mountains are, in

in general, adapted only to pasture and the growth of wood, although in many places fertile cultivated vales are interspersed; but the lowlands present many tracts of land which, both by the nature of the soil and the skilful industry of the inhabitants, furnish excellent crops of every kind of grain: and such is the attention bestowed by the proprietors and farmers of most parts of the country, that agriculture is in Scotland now generally carried on, though less extensively, yet more scientifically than in England.

Mountains.—In a country generally so mountainous as Scotland, it is not easy to point out the most distinguished eminences. The highest land in Scotland, and indeed in Britain, is the mountain called Bennevis, in the county of Inverness, which rises to the height of 4,387 feet. The range which, extending from the south-west to the north-east, divides the highlands from the lowlands, has obtained the name of the Grampians, although no part of it is in the country known by that designation. The southern parts of Scotland also present an assemblage of mountains, one of which, Hartfell, is estimated to be in height about 3,300 feet. The Cheviot hills which for many miles form the boundary between Scotland and England, are a separate range of considerable elevation. Many of the Scotch hills present the singular appearance of detached cones, greatly resembling Etna and Vesuvius, as if they were the productions of volcanoes in very remote times; such are North Berwick Law in East Lothian, Largo Law in Fife, Dundee Law, &c.

Rivers. The principal rivers of Scotland, going up the east and coming down the west coasts, are, 1. The Tweed, which receiving sundry pastoral streams, and for some miles separating the two kingdoms, falls into the sea at Berwick. 2. The Forth, which proceeds from a number of lakes on the southern borders of the highlands, and flowing south-easterly by Stirling, gradually enlarges into the noble estuary called

called the Firth of Forth, washing the shores of Fife on the north, and of the three Lothians on the south, lined on both sides by towns and harbours, of which Leith is the chief, and communicating with the German ocean by an opening a dozen miles across, being navigable for the largest vessels forty miles up from the sea. 3. The Tay issues from a lake of the same name, and, following a winding course, receives the waters of a number of considerable streams, particularly the Erne, soon after which it opens into the Firth of Tay, navigable for large coasters to Perth, and for ships of any burthen to Dundee, situated 18 miles lower down, but six miles up from the sea. 4. The Dee runs from west to east, and forming the harbour of Aberdeen, discharges itself into the German ocean. 5. The river Spey, an impetuous stream, flows in general to the north-east, and falls into the Moray Firth. 6. The Ness, which proceeds from the lake of the same name, and united with some smaller streams, gives rise to the vast estuary or firth of Moray. 7. The northern and western parts of the country afford abundance of small torrents; but no river of consequence is met with all the way south to the firth of the Clyde, a river which, rising in the central mountains of the south, runs in general north-westerly, furnishing a channel for the immense industry and commerce of Glasgow, Paisley, and other manufacturing towns in that quarter of the kingdom. Advantage has been taken of the firths of the Clyde and the Forth to open a communication for large coasting vessels, by means of a canal joining the two rivers, quite across the island, from the Atlantic to the German ocean. The length of this canal is 35 miles, the breadth 56 feet, and the depth 7 feet: the elevation of the canal in the interior of the country is not less than 155 feet above the sea. Another communication has been begun, from the Atlantic to the German ocean, by opening a chain of short canals, connecting a number of lakes, extending from south-west to north-east, and terminating

minating below Inverness. This canal is to be of such a size as to admit ships of 1200 tuns, and frigates, to pass from the one sea to the other, and thereby diminish the hazard to which vessels are exposed in the long and difficult navigation round the western and northern coasts and islands of Scotland. The canal of Crinan will enable small vessels from the Clyde to pass directly out to sea, without making a dangerous and tedious run along the great promontory of Cantire. 8. The Ayr and other remaining rivers on the west coast, are of consequence as affording convenient tide-havens: and on the south coast the Nith, after a considerable course from the north-west, passes by Dumfries, the principal town of that part of the country, and falls into the Solway Firth near its opening into the Irish sea.

Lakes. From the mountainous nature of the country, Scotland presents a vast variety of lakes, generally situated in deep vallies, where the torrents unite, and from which, the mud and gravel with which they were loaded being deposited, issue a number of lively and beautiful streams, hurrying with a brisk course to the sea. The lakes in Scotland are termed lochs, a word which, like loughs, the corresponding name employed in Ireland, is pronounced like the syllable loh.

Loch Lomond, out of which flows the river Leven, which soon after falls into the Clyde at Dumbarton, is the largest and most beautiful of the Scotch lakes; it is of a triangular form, 24 miles from north to south, and the base from west to east is about six miles; it presents a multitude of isles, and the shores are mountainous and romantic.

Loch Tay and Loch Erne, furnishing large rivers of the same names, adorn and enliven the highland parts of Perthshire; and Loch Ness, forming a main link in the chain already noticed, as constituting a part of the great intended communication from sea to sea by Inverness, is noted for its

great

great depth, varying from 60 to 135 fathoms, on which account the surface has seldom, if ever, been known to be frozen.

But it is not to the highlands alone that lakes are confined, for the lowlands present a number of interesting pieces of water, whose beauties are of a different and a milder sort: of such is Loch Leven on the northern borders of Fife, noted for its trout, and for containing the island and its castle, once employed as the prison of the ill-fated Mary, queen of Scots.

It was formerly observed that in Scotland many inlets of the sea, running deep into the land, are known by the name of loch: of these inlets the western coasts furnish many examples, such as Loch Broome, Loch Linny, Loch Fyne, &c. noted stations for the herring fishery.

Mineral Productions. Lead, iron, and coal, are those of the greatest importance now procured in Scotland. The lead mines in the central mountains of the south, hence called the Lead-hills, are considered by mineralogists as the richest in Europe.

Iron is found in great abundance in many parts of the country; and at Carron in Stirlingshire this ore is smelted, and the metal is converted into a vast variety of shapes, for the accommodation of human life, and also for its destruction; for at Carron, besides the founding of the ordinary cannon, were first produced those pieces of ordnance, hence called *carronades*, which being much shorter, lighter, and consequently more manageable than any other sort of the same calibre, are admirably calculated for engagements at short distances, and thus peculiarly adapted for British seamen, who value themselves on running nearer to the enemy, and standing closer to their guns in action, than those of any other country. The original idea of the construction, uses, and advantages of the carronades, was furnished, many years ago, to the conductors of the works at Carron, by *General*

Robert

Robert Melville: and so useful has this species of ordnance been found in actual service, as now to be adopted in the navy of every nation of Europe.

The most valuable mineral, however, which Scotland furnishes is coal, which has been worked as far back as the 12th century. The great bed in that country stretches across the middle of the kingdom, from west-south-west to east-north-east, pervading sundry districts of the counties of Ayr, Lanark, Stirling, the three Lothians, Perth, Fife, &c. of which last county the whole coast along the Firth of Forth, besides many interior tracts, rests upon strata of excellent coal. This substance has also been discovered in certain parts of Ross and Sutherland.

Granite, free-stone, limestone, marble, slate, &c. are found in abundance in Scotland; and from that country were drawn the stones with which many of the streets of London are paved.

Mineral waters of various qualities have long been known in Scotland, but either from their inferior powers, from the influence of fashion, or from some other causes, they have not arrived at great celebrity: those of Peterhead in the north, and of Moffatt in the south, are the most frequented.

Animals.—The animals of Scotland differ little from those of England, unless we consider the small horses of Galloway and the still smaller race of the Shetland isles, as peculiar to those parts of the country. Vast droves of cattle are annually brought from the highland districts to be fattened in the English pastures, when they furnish the most delicate provision for the table. The sheep are generally of a small breed; but like the Welch and the South Down sheep, they afford excellent mutton. The roe is still frequently seen in the mountains; but no wolf has been discovered for above these hundred years.

The numbers and varieties of sea-fowl which frequent, and in many places literally cover the rocky shores, are

prodigious;

prodigious: but the greatest treasures of the animal world in Scotland, are the multitudes of fish with which its seas are filled. The whale frequently appears, and the basking shark often shows himself in the western bays. The herring presents itself in vast abundance, all along both the eastern and western shores; and the salmon is so plentiful in the rivers, that the exportation to England and other countries, forms a very considerable article of eommeree. Pearls are also found in a species of mussel, in several of the Scotch rivers and lakes.

Vegetables.—The lowlands of Scotland in their vegetable produetions, differ little from England; but in the mountainous traets of the highlands, many plants are found which only in the Alps, and other elevated regions, are met with. In the highlands also are vast natural forests of pine and bireh; and plantations of various sorts of timber have, for many years past, been carried on by a number of great proprietors, to an extent of whieh it is difficult to form a conception.

Islands.

The Island of Britain possesses a multitude of smaller isles, scattered along its shores, particularly on the west and north parts. Holy island and Coquet lie under the shores of Northumberland. Thanet in Kent was onee an island separated from the mainland by a navigable channel, on which at Richborough the *Rhutupiæ* of the Romans, was a principal station for ships.

Wight.—On the coast of Hampshire lies the Isle of Wight, rich and beautiful; about 20 miles long by 12 miles broad.

Portland.—The isle of Purbeck is properly a peninsula; but

but the vast mass of stone composing the isle of Portland, has evidently been surrounded by the sea.

Scilly.—About 26 miles west from the extremity of Cornwall, lie the isles of Scilly or Silley, a cluster of low rocks and islands, of which the largest, St. Mary's, is about 5 miles in circuit. The whole population of these isles is about 1000 persons.

Anglesey.—A number of small isles line the shores of Wales; but Anglesey at the north-west corner is a considerable and fruitful island, being 25 miles long, and 18 broad; the chief town is Beaumaris. This island is the *Mona* mentioned in Tacitus' life of Agricola, and is now remarkable for its invaluable copper mine, in the Parys mountain already mentioned: from Holy-head on the most advanced point is the established passage from England to Dublin.

Mann.—In the midst of the Irish sea, at nearly equal distances from England, Scotland, and Ireland, lies the isle of Mann, the *Monæda* and *Menavia* of the Romans: its length from north to south is about 30 miles, and its greatest breadth about 15 miles. The island is in general hilly, Mount Snafel in the middle rising to the height of 1,640 feet. It produces lead, copper, and iron, with limestone and slate, and contains about 40,000 inhabitants, members of the church of England, under their own bishop, who although within the province of the archbishop of York, has no seat in the British house of Peers.

This island formerly had kings of its own, and it remained in many respects independent on Britain down to the year 1765, when government purchased the sovereignty of the proprietor, the duke of Athol.

The interior of Mann is in general bleak and unproductive, but the shores and vales afford good pasture and corn. The principal towns are Douglas, Castletown, and Ramsay.

HEBUDES.—The whole western coast of Scotland is covered with a range of islands, some of them of considerable size, called in general from their situation with respect to that country, *the western islands*: but they are mentioned by Pliny, Solinus, and Ptolemy, by the name of *Hebudes*, or *Ebudæ*, terms which for some time past have been frequently but absurdly corrupted into *Hebrides*.

Arran.—Two islands lying in the entrance of the Firth of Clyde, are, however, not reckoned amongst the Hebudes: these are Arran and Bute. Arran is a mountainous island 23 miles in length and 9 in breadth, containing about 7,000 inhabitants.

Bute.—Bute is in length 12 miles and in breadth 4 miles: the inhabitants about 4800: the chief town is Rothsay, which gives the title of duke to the Prince of Wales.

Ilay.—Proceeding from south to north, the principal islands of the Hebudes are, Ilay, 24 miles long by 18 in breadth; the inhabitants 12,000. This island produces some copper and lead, and exports great numbers of cattle.

Jura.—This island is 20 miles in length, by 5 in breadth, extremely mountainous and ragged, the highest of the singular conical summits, called the Paps, rising 3,400 feet above the sea: the inhabitants about 1200. On the north end of this island is situated the dangerous whirlpool called Corry Vrecan, which, according to the state of the tide, extends its fury for above a mile in diameter.

Mull.—Mull, lying close to the continent of Scotland, is one of the largest of the Hebudes, being 28 miles in length, and 18 in breadth, containing above 8,000 inhabitants.

Iona.—Adjoining to the south-west corner of Mull, is Iona, or Y-columb-kil, so early as in the sixth century the seat of religion and literature.

Staffa.

Staffa.—A few miles to the northward of Iona lies the celebrated and singular Staffa, a small island entirely composed of groupes of basaltic columns.

Skye.—To the northward of Mull is Skye, about 45 miles long, but of very unequal breadths in different places: the inhabitants are about 15,000: the island is hilly and rugged, producing little corn, but exporting numbers of cattle and small horses.

Lewis.—Twenty miles north-west from Skye is situated the island of Lewis, the largest of all the Hebudes, being about 60 miles in length from south to north, and above 20 in breadth in the middle; but narrow at each end. The interior of this island consists of mountains covered with heath, but the shores produce oats, barley, flax, and hemp. The animals are, the red deer, horses, cattle, goats, and hogs. The chief place in the island is Stornaway, a considerable town, situated on a bay forming an excellent harbour.

Vist.—Near the south end of Lewis is North Vist, an island of the same description, but less considerable; being in length about 22 miles by 17 in breadth.

Orkney Islands.—Separated by a channel of the breadth of a few miles from the most northerly point of Scotland lie the Orkneys, twenty-six in number, composed of a cluster of small isles scattered round the largest, called Mainland. The inhabitants of the whole are reckoned at about 24,000. The principal town is Kirkwall, seated on a good harbour, and formerly a bishop's see, the cathedral, a venerable gothic structure, still remaining in good condition: These islands export cattle, hides, salt fish, tallow, coarse linen, and frequently corn; the soil of Mainland is in general good but shallow.

Shetland Islands.—About thirty miles from the most northerly of the Orkneys, lies the most southerly of the Shetland islands, a cluster resembling the Orkneys, having

a large

a large island, also called Mainland, in the centre, much indented by the sea, but in a general sense about 55 miles long from north to south, and in the centre about 15 in breadth, although in many places not above two miles across. The only place of note in these islands is Lerwick, a small town seated on a circular bay, forming an excellent harbour, completely landlocked by the isle of Brassa, whence the bay is called Brassa Sound, a much-frequented place of rendezvous for vessels employed in the northern fisheries. The inhabitants of the Shetland isles are computed to exceed 20,000.

Alderney.—About 50 miles due south from the isle of Portland, and 9 miles west from Cape La Hogue in France, lies the little isle of Alderney, eight miles in circuit; the inhabitants being reckoned nearly 1000. The strait between this island and France, called the Race of Alderney, is noted for the impetuous and dangerous setting of the currents at particular states of the tide.

Guernsey.—South-west from Alderney 18 miles lies *Guernsey*, of a triangular shape, being 12 miles in extent from east to west, and 9 from south to north; a fruitful island, healthy, and well-peopled; the chief town is St. Pierre, having a good harbour on the east side.

Jersey.—Twenty miles south-south-east from Guernsey is situated Jersey, a pleasant, fruitful, and well-cultivated island, in length about 12 miles and in breadth from 5 to 6. The chief town is St. Helier, situated on the east side of a fine bay, on the south side of the Island. The inhabitants are supposed to amount to 20,000.

These islands are independent of the British parliament, being governed under the Crown by their own laws, and are all now remaining to the kings of England of their antient possessions in France.

III.

III.

IRELAND.

Situation and extent.—The figure of Ireland inclines to an oval or rather to a losenge; the northern extremity lying in N. lat. 55° 23′, and the southern at Cape Clear in lat. 51° 19′. The extent in longitude is from 5° 36′ to 10° 45′ west from Greenwich; but the length in a diagonal from south-south-west to north-north-east is about 310 English miles, and the greatest breadth in the middle is about 160 miles. The superficial area of the island has been computed to be 30,370 square miles, or 19,436,000 acres.

Ireland is divided into four grand districts or provinces, each of which contains a number of inferior districts or counties, as in the following list, which likewise shows the names of the chief towns of each county.

Provinces.	Counties.	Chief Towns.
Ulster -	Antrim	Carrickfergus
	Down	Downpatrick
	Armagh	Armagh
	Tyrone	Omagh
	Londonderry	Londonderry
	Donegal	Lifford
	Fermanagh	Enniskillen
	Cavan	Cavan
	Monaghan	Monaghan
Connaught -	Leitrim	Carrick on Shannon
	Sligo	Sligo
	Roscommon	Roscommon
	Mayo	Castlebar
	Galway	Galway

Leinster

Provinces.	Counties.	Chief Towns.
Leinster -	Louth	Dundalk
	East Meath	Trim
	Dublin	DUBLIN
	Wicklow	Wicklow
	Wexford	Wexford
	Kilkenny	Kilkenny
	Carlow	Carlow
	Kildare	Naas
	Queen's county	Maryburgh
	King's county	Philipstown
	West Meath	Mullingar
	Longford	Longford
Munster -	Clare	Ennis
	Limerick	Limerick
	Kerry	Tralee
	Cork	Cork
	Waterford	Waterford
	Tipperary	Clonmell

The population of Ireland has been very variously stated, some authors allowing only three millions and a half, whilst a late well-informed writer estimates the number of inhabitants in 1804, to be nearly five millions and a half. The following list contains an estimate of the population of some of the principal towns.

Dublin - -	170,000
Cork - -	80,000
Limerick - -	50,000
Waterford - -	35,000
Belfast - -	20,000
Kilkenny - -	16,000
Dundalk - -	15,000
Galway - -	12,000
Wexford - -	9,000
Kinsale - - -	8,000

Climate and soil.—Ireland and England being situated at equal distances from the equator, the climate of the two countries

countries is nearly alike: although in Ireland it has been observed that the winters are now less severe, but the summers more cold and rainy than they formerly were, chiefly occasioned by the late greater prevalence of the gales from the Atlantic, which render the climate of the western and southern provinces very humid.

Ireland may, in general, be regarded as a plain country, the highest mountain, Slieve Donard, in the county of Down, being reckoned to rise but a little above 3,000 feet, or rather, agreeably to the latest observations, to 2,800 feet, above the sea: and the hills seldom form ranges of much extent, being in general distributed in small groupes or in single eminences. The soil is naturally fertile, and under a proper system of agriculture, might be made to produce vast quantities of grain: for even with all the present impediments to improvement, Ireland is still a very fruitful country. From the extreme moisture of the climate, the pastures furnish food for prodigious numbers of black cattle, the exportation of which in the form of salt provisions produces a great income to the country.

Vast tracts of Ireland are covered with bogs of various sorts, some marshy, others clothed with grass, and dry in the summer, and a third kind consisting of peat moors. Of these bogs, many instead of being flat and level, like a marsh in England, are varied into hill and dale, as if they were solid dry ground: their common productions are heath and coarse grass.

Mountains.—These in Ireland are neither numerous nor extensive, although a range of high land may be traced in the direction of the length of the island, from whence the waters run to opposite shores. Slieve Donard has already been mentioned: in the neighbourhood of the lake of Killarney is Mangerton, estimated at 2,500 feet of elevation. Cruagh Patrick and Nephin, both in the county of Mayo,

are

are above 2,600 feet in height. To the southward of Dublin is a small range called the Wicklow mountains.

Rivers.—The chief rivers of Ireland are, 1. The Shannon, which rising in the north-west part of the kingdom, runs southerly, spreading out in different places into wide lakes, and then bending southwesterly forms the harbour of the prosperous town of Limerick, and falls into the Atlantic 60 miles lower down in the shape of an estuary, 10 miles over. The course of the Shannon is about 170 miles. 2. The Barrow, rising west from Dublin, flows for about 100 miles to the southward, and falls into the Irish Channel below Waterford, where it forms an excellent harbour. 3. The Liffey, is chiefly remarkable as flowing through the centre of Dublin, where it is navigable for vessels of a moderate size. 4. The Boyne, memorable for the decisive victory gained on its banks over James the Second, which seated William the Third on his throne, flows from west to east, and falls into the sea below Drogheda. 5. The Bann, which falls into and runs out of the great lake Lough Neagh, holds a northerly course of about 70 miles. 6. The Foyle, waters Londonderry, and then opens into the broad estuary called Lough Foyle.

Lakes.—Ireland possesses a number of considerable lakes, there called Loughs, such as Lough Neagh in the north part of the island, which is 22 miles in length by twelve in breadth. Lough Erne, in the north-west quarter, consists properly of two lakes, connected by an outlet inclosing an island, on which stands the town of Enniskillen : the length of the two lakes together is about 30 miles, and the greatest breadth is about 10 miles. This lake is beautified by clusters of little isles : but Lough Neagh is one continued expanse of water. In the county of Galway is Lough Corrib, 20 miles long, and from 2 to 5 broad. The most beautiful of the Irish lakes however is the Lough of Killarney,

in

in the south-west corner of the island, surrounded with picturesque scenery of rock, wood, and mountain.

Mineral Productions.—Iron is found in abundance in many parts of Ireland, and some veins are of an excellent quality, and copper is sent over to Wales to be smelted: lead is also met with in very considerable quantities, often intermingled with silver: but the public attention has for some time past been powerfully attracted by the discovery of masses of native gold in a brook in the Wicklow mountains, on the south side of Dublin.

Coal has also been found in various parts of Ireland, particularly in the north; but the beds have not been worked to a proper extent, so that Dublin and many other maritime towns are chiefly supplied with coal from Wales, Cumberland, and Scotland. Marble, freestone, and slate, are frequent in Ireland; and on the northern extremity of the island is the celebrated Giant's Causey, a prodigious assemblage of basaltic columns, similar to those composing the island of Staffa, about 80 miles to the northward on the coast of Scotland. This curious natural production extends above 600 feet into the sea, where it is lost, on a breadth of from 240 to 120 feet, composed of many thousand pillars, generally in a vertical position, in some places broken off to an equal height, so as to resemble a piece of pavement, whence it has its name: the pillars of various shapes, but commonly pentagonal.

The mineral waters of Ireland, although frequent, have never become very famous, owing probably as much to the caprice of the patients, as to the defectiveness of the waters: the sulphureous springs of Swalingbar, in the county of Cavan, and the chalybeate waters of Ballynahinch, in the north, and Castleconnel, in the south-west, are the most noted.

Animals.—In the animal kingdom, Ireland differs not sensibly from England: no poisonous animal, it is asserted,

is found in the former country, in which case the viper ought to be a stranger, which is the only poisonous animal in England. The numerous heads of black cattle have already been noticed: and the small race of horses are remarkable for their easy motions. Deer of a gigantic size must in ancient times have abounded in Ireland, for their horns, some not less than 14 feet from tip to top, have often been found deep buried in the bogs. The Irish hound, a large and majestic animal, is now become very scarce: from their being used to scour the country against wolves they acquired the name of the Irish wolf-dog.

Vegetables.--From the early accounts of Ireland it appears that the country was once over-run with forest; but now these have almost entirely disappeared. The botany of Ireland may be considered as perfectly similar to that of England: but the rich pastures of the former country present various sorts of grass, which are in a great degree peculiar to it. The *arbutus unedo*, a particular kind of the strawberry tree, is one of the natural ornaments of the environs of the lake of Killarney. The culture of the potatoe is in Ireland carried to such a degree of extent and perfection, as to become the principal article in the food of the great body of the people.

Islands.—These are neither numerous nor considerable. Cape Clear, commonly considered as the southernmost point of Ireland, is in fact the extremity of a small island situated at a short distance from the land. Valentia, and some other isles of little importance, line the coast of Kerry. In the bay of Galway lie the south isles of Arran. Off the coast of Mayo is situated Achill, 12 miles in length by 9 or 10 in breadth. On the northwest point of the kingdom lie the north isles of Arran, and Tory, a well known mark for seamen. Rachlin, a small island on the northern part of Antrim, is chiefly remarkable as having been noticed by Ptolemy under the name of *Ricina*.

RELIGION.

RELIGION.

The protestant reformed religion is by law established in all the British isles, with certain differences relating more to the forms of church-government, and the external rites and ceremonies of divine worship, than to the system of doctrines professed by each communion. In England and Ireland the established system is that peculiarly styled, *the Church of England*, which at the Reformation retained the hierarchy or episcopal form of government. In Scotland the presbyterian form has been adopted, in which the whole body of the clergy are perfectly equal in rank and dignity, and all ecclesiastical affairs are administered by a gradation of elective and representative assemblies of the pastors and lay-elders.

In England are two archbishops, those of Canterbury and York: under Canterbury are, the bishops of London, Winchester, Litchfield and Coventry, Lincoln, Ely, Salisbury, Exeter, Bath and Wells, Chichester, Norwich, Worcester, Hereford, Rochester, Oxford, Peterborough, Gloucester, Bristol, Landaff, St. David's, St. Asaph, and Bangor: under York are, the bishops of Durham, Carlisle, Chester, and the Isle of Mann, or of Sodor and Mann.

In Ireland are four archbishops, those of Armagh, Dublin, Cashel, and Tuam: under Armagh are, the bishops of Meath, Kilmore, Dromore, Clogher, Raphoe, Down and Connor, and Derry: under Dublin are, the bishops of Kildare, Leighlin and Ferns, and Ossory: under Cashel are, Waterford and Lismore, Limerick and Ardfert, Killaloe and Kilfenora, Cork and Ross, and Cloyne: under Tuam are, Clonfert and Kilmacduagh, Killalla and Achonry, and Elphin.

In Scotland the parishes are 941, distributed into 78 presbyteries, which compose 15 synods, the whole united in one general assembly held every year at Edinburgh.

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Those who dissent from the establishments in England and Scotland, are numerous, and divided into various classes: but in Ireland the dissenters of all descriptions, are by far the most numerous body of the people. By a late calculation those who profess the Roman catholic religion in Ireland, form no less than fourth-fifths of the whole population of the kingdom; and of the remaining fifth the presbyterians alone, who are chiefly found in the north, amount to half a million.

Universities.—In England there are two universities, Oxford and Cambridge; in Scotland four, viz. St. Andrews, Glasgow, Aberdeen, and Edinburgh. Ireland contains but one university, viz. Dublin.

Government.—On the death of Queen Elizabeth in 1603, James the Sixth of Scotland, succeeding in right of blood to the kingdom of England, the two crowns were united, and so continued until the year 1707, in Queen Ann's reign, when the two kingdoms were united under the name of Great Britain: but Ireland continued a separate state until the 1st January 1801, when the three states were formed into one, styled the United Kingdom of Great Britain and Ireland. The constitution of this great kingdom is a limited monarchy, balanced by two senates or houses of parliament, the one consisting of hereditary peers, the other of representatives chosen by the people.

II.

DENMARK AND NORWAY.

The kingdom of Denmark and Norway, which are only separated by the channel or entrance of the Sound about 70 miles across, are situated between the mouth of the Elbe in

in N. lat. 54°, and the north cape of Lapland, in lat. 71° 10′; the extent from north to south on a meridian, is about 1030 geographic, or 1200 English miles; that of Denmark alone being 250: but the breadths are very unequal; that of Denmark being about 150 English miles; the southern parts of Norway 240; but in the northern parts not 40.

The population of these countries is estimated at about 2,500,000. The capital of Denmark, and of the whole dominions, is Copenhagen, a handsome town, containing 90,000 inhabitants, with an excellent harbour on the east side of the island of Zealand. Bergen is the chief town of Norway, containing about 20,000 inhabitants. Altona on the north shore of the Elbe, contiguous to Hamburgh, is a thriving modern town, inhabited by 25,000 people. Other considerable towns are, Christiana, a seaport in the south of Norway, exporting great quantities o timber, iron, and copper. Drontheim, another port in the north, contains 8,000 inhabitants.

In countries stretching so far towards the pole, great variety and great severity of climate must be expected. Even in Denmark, the Sound and other straits between the islands are covered with ice in winter, so as to preclude all navigation. In Holstein and the southern parts of Jutland, as well as in Zealand, and some other isles of Denmark Proper, which are all low and flat, the soil is generally fertile in grain and in pasturage: but Norway, a very mountainous country, produces very little grain, with some good pastures; and vast forests of fir and pine. Denmark affords but a few streams of little importance; but in the south of Norway, are several rivers, particularly the Glom, which although, on account of the precipices in its channel, it is not navigable, yet contains a great body of water, and serves to float down multitudes of trees to the coast for exportation.

Norway presents a number of lakes, some of considerable

size

size, and the vast chains of mountains dividing it from Sweden, rise in many places to the height of 9,000 feet.

Holstein, and the southern parts of Jutland, produce many large and excellent horses and cattle, and in Lapland is found the rein-deer, a most useful animal to the inhabitants of that remote and inhospitable region.

Norway possesses valuable mines of silver, sufficient for the supply of the Danish mint; copper and iron are also found there in great abundance.

The whole coast of Norway is covered with multitudes of small, rocky, and in general uninhabited islands: but to the Crown of Denmark belongs the great island of Iceland, situated in the Arctic ocean between lat. 63° 30′ and 66° 45′, and between long. 16° and 25′ west from Greenwich. The inhabitants are computed to be 50,000. Iceland possesses the celebrated volcanoe, Hecla, besides some very extraordinary fountains, which discharge prodigious columns of boiling water to a considerable height. The climate of this remote island, although cold, is not unwholesome. The country is thus described by some travellers from Britain who visited Iceland in August 1772—"Imagine to yourself a country which, from the one end to the other, presents to your view only barren mountains, whose summits are covered with eternal snow, and between them fields divided by vitrified cliffs, whose high and sharp points seem to vie with each other to deprive you of the sight of a little grass which scantily grows up among them. These same dreary rocks likewise conceal the few scattered habitations of the natives; and no where a single tree appears which might afford shelter to friendship and innocence. The prospect before us though not pleasing was uncommon and surprising: whatever presented itself to our view bore the marks of devastation; and our eyes accustomed to behold the pleasing coast of England, now saw nothing but the vestiges of a fire, heaven knows how ancient."

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The Feroe Islands, a cluster of small lofty isles situated nearly half way from the Shetland islands to Iceland, also belong to Denmark; they contain about 5,000 inhabitants.

The dominions of the King of Denmark profess the Lutheran system of the Protestant religion; and the government, ever since the revolution of 1660, has been considered as an absolute monarchy.

III.

SWEDEN.

SWEDEN is situated between 55° 20′, and 70° of north latitude, and between 12° and 29° of longitude east from Greenwich, being about 1,150 English miles in length, and about 550 in its greatest breadth, including the gulf of Bothnia. The population has been computed to amount to about three millions.

Great varieties of climate are found in Sweden, according as districts are situated more or less towards the pole; but even in the southern provinces, the winters are severe and tedious. It was already observed that the strait dividing Denmark from Sweden is usually closed by the ice in winter; and the gulf of Bothnia, forming a vast bason in the heart of the kingdom, is frozen over even at the entrance, so that travellers cross from Sweden to Finland by the isles of Aland on the ice. In the northern regions, where the sun is visible at midnight for some weeks in summer, the heats are often considerable.

Sweden Proper is greatly diversified by mountains, rocks, lakes, rivers, and forests: and Finland abounds in marshes, lakes, and woods, of vast extent. The soil of Sweden, not

 naturally

naturally of the best quality, is cultivated with such care and skill, as to make very liberal returns for the pains bestowed on it.

The loftiest mountains are found in the long chain separating Sweden from Norway; and in those tracts, particularly in Dalecarlia, are found the vast forests of pine and fir, whence supplies are drawn to many parts of Europe.

Sweden presents many rivers, of which the most considerable is the Dahl, which, rising on the Norwegian frontiers, runs south and east for above 250 miles, and precipitating itself over a ledge of rocks above 30 feet high, soon after falls into the gulf of Bothnia. The Tornea, rising in the Lapland mountains, runs southerly, and discharges itself into the bottom of the gulf of Bothnia, below the town of Tornea.

The lakes are both numerous and of a great size: the Wener is about 100 English miles long by 50 broad: the Weter is about as long, but not half the breadth: the Meler is 60 miles long by 18 broad, communicating with the Baltic by a channel full of islands and rocks, on which is built Stockholm, the capital of the kingdom. Finland presents many lakes, of which Pejend is said to be 80 miles in length by 15 in breadth. Other vast expanses of water form the boundary between Finland and Russia.

Sweden is rich in mineral productions: gold has long been extracted, as also some silver: but the treasures of the country consist in its mines of copper and lead, and above all in those of iron, which, in certain districts is found in vast abundance, and of the first quality. Swedish steel has long been celebrated, which, with iron in its rough state, timber, tar, hemp, copper, and herrings, forms the exportation of the kingdom, in return for which other necessary articles, particularly grain, are imported.

The capital of the Swedish dominions is Stockholm, already noticed, containing 80,000 inhabitants, with an excellent

cellent harbour, but of difficult access. Upsal was once more considerable, but now contains only about 3,000 inhabitants, without the students of the university, where the father of modern botanical science, Linnæus, divulged to the world the knowledge he had acquired, in the various regions of the history of nature. Gottenburg contains 30,000 people, a handsome sea-port, noted for its commerce, and the share it possesses in the herring fishery. Carlscrona, at the southern extremity of Sweden, is a modern town, of 11,000 inhabitants, where very extensive works have for some time been carrying on, to form a complete station for the Swedish navy.

To the crown of Sweden belong several islands lying in the Baltic: the isles of Aland, situated in the entrance of the gulf of Bothnia, are a cluster of which the largest is in extent about 40 miles by 15, containing 9,000 inhabitants. Gothland is in length 70 miles, and in its greatest breadth 24, fertile in corn and sheep pasture. Œland, a long narrow island, in extent 70 miles by 6, contains about 8,000 people, and produces timber and corn. The fertile isle of Bornholm, although situated near to the south coast of Sweden, has for many years been a part of the Danish dominions.

On the south shore of the Baltic, Sweden possesses a share of the province of Pomerania, together with Rugen, an island lying out before it. These districts are fertile in corn and cattle, maintaining a population of above 100,000 inhabitants: the capital of Swedish Pomerania is Stralsund, a considerable sea-port and fortified town: Bergen is the chief town of Rugen.

Lutheranism is the established religious profession of the Swedish dominions; and the constitution since the year 1789, is in fact an absolute monarchy; for although the diets or assemblies of the states are not abrogated, the administration of justice, and even the imposition of taxes, are in a manner solely in the hands of the king.

IV.

RUSSIA.

The vast Russian empire occupies the whole northen parts of Europe and Asia, from the frontiers of the Swedish dominions in Finland, to the strait which separates Asia from America, that is, from long. 30° to long. 190° E. from Greenwich; a distance upon the arctic circle, where this measure must be taken, equal to 4452 English miles*; but further to the southward, in lat. 55°, the Russian territory begins at long. 22° E. from Greenwich.

The greatest extent of the European part of this immense empire, on the parallel of 55°, is about 1400 English miles, and that from the Black Sea to the Arctic ocean, on a meridian, is about 1700 miles. By the latest estimation, the population of Russia in Europe amounts to 33,000,000.

Russia, in Europe, occupying a position between the parallels of 45° and 70° of N. latitude, must possess a great variety of temperature, climate, and soil. The country is, in a general sense, one vast plain, varied by successions of gradual swellings, but without any mountainous tracts of noticeable elevation, the highest land in the heart of the empire, where the great rivers have their origin, not being more than 1,200 feet above the sea. The mountains of Olonetz, however, forming the boundary with Sweden, and the Uralian mountains, which divide Europe from Asia, attain considerable heights.

* At the arctic circle a degree of longitude is equal to about 27,83 English miles, consequently 160° of longitude on that parallel are only equal to 4452 miles. By some unaccountable oversight, the length of the Russian Empire is, in a recent ample work on geography, said to be 9,200 English miles; an extent which, at the arctic circle, would be equal to 330° of longitude, nearly encompassing the whole globe of the earth.

From

From its extent Russia presents many rivers of importance: the Volga, the largest stream in Europe, rising between Petersburg and Moscow, flows for above 1,700 miles, being in the latter half of its course the boundary of Europe, and entering Asia, discharges itself into the Caspian sea below Astracan. The Don, after a winding course of 800 miles, is lost in that gulf of the Black sea called the Sea of Azof. The Nieper runs for about 1000 miles to the Black Sea, which also receivs the Neister after a course of 600 miles. Considerable streams rising in Russia pursue their course in a different direction, as, for instance, the Petshora, which by a course of 450 miles falls into the Arctic or Frozen Ocean; the Dwina discharging itself, after a course of 500 miles, into the White Sea, a few miles below the port of Archangel; the Duna, which having its sources at no great distance from those of the Volga and the Nieper, flows north-westerly for 500 miles, and is lost in the Baltic below the noted trading town of Riga.

In the northen parts of Russia are many considerable lakes: Ladoga is the largest in Europe, being 130 miles in length and 70 in breadth: Onega is in length 150 miles, but its breadth is only about 30 miles. Near the shores of the Baltic is the lake of Peypus, in extent 60 miles by 30.

Russia, in Europe, possesses some inconsiderable mines of gold in the Olonetz range: but it produces plentifully iron and copper; and in various places mineral waters, chiefly chalybeate, have been found.

The population of Russia is composed of various races: the Laplanders on the north-west; the Samoiedes on the north-east corner of the country; the Fins in the neighbourhood of Petersburg, the great body of the inhabitants, or Russians, properly so called; the Tartars, or Tatars, of the southern provinces, although united under one sovereign, still retain many distinctive and characteristic marks of their origin, in stature, complexion, language, customs, and religion. From

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the white bear of the islands on the northen coast, to the camel of the southern provinces, Russia produces all the varieties of the animal world known in Europe.

This country abounds with forests of vast extent: the road from Petersburg to Moscow leads for 150 miles through the forest of Volkonski, composed of oak, beech, mountain-ash, pine, and fir. The trees found in greatest abundance are the fir and the pine, furnishing at Memel and other ports unexhausted supplies of timber, pitch, &c. to many parts of Europe. Hemp and flax are also exported in great quantities, and of the best quality.

Contiguous to the northern shores of Russia, lies the extensive cluster of barren, uninhabited islands called in general Nova Zembla, or more properly Novaya Zemlia, that is, the New Land, stretching in the form of a crescent between lat. 70° and 77°, and resorted to in the summer for the sake of the seals, foxes, and white bears found on its desert shores.

Some authors have considered the remote islands of Spitzbergen, lying between lat. 76° and 80° as belonging in some respects to the Russians, who have attempted to form a settlement on them, for the convenience of the whale fishery, which in that part of the northern ocean is the most abundant.

North-east from these isles lies a small group called the Seven Sisters, the most northerly land hitherto discovered.

The prevailing religion of Russia is the Christian system of the Greek Church, differing in many essential points from that of Rome, and holding in a considerable degree a middle course between it and protestantism. The government of the Russian empire is completely despotic, the will of the sovereign being the only legal authority.

V.

HOLLAND.

The country lying along the shore of the German ocean, opposite to England, and adjoining to France on the north, being low and flat, and in many parts covered with marshes and lakes, was long ago distinguished by the name of the *Low Countries*, or the *Netherlands*. Whilst this tract belonged to the house of Austria and the crown of Spain, it was divided into seventeen provinces; but the seven most northerly provinces, towards the end of the 16th century, throwing off their allegiance to Philip II. of Spain, formed an independent republican state, under the title of *the Seven United Provinces*, while the remaining ten continued under the house of Austria, until, in the course of the revolutionary war with France, they were conquered by that power, and finally at the peace incorporated with it.

The Seven United Provinces are generally known by the name of Holland, which is the most considerable of the number; the other six being, Friesland, Groningen, Overyssel, Utrecht, Gelderland, and Zealand. The extent of the whole territory is about 150 English miles from north to south, by 100 from west to east, the number of square miles being computed at 10,000, occupied by about 2,758,000 inhabitants, or nearly 256 for each square mile, a proportion greater than that of any other country in Europe.

Great part of the territory of Holland being taken up with rivers, canals, marshes, lakes, and inlets of the sea, the climate is extremely moist, and although no part of the country be situated so far to the northward as the mouth of the Humber in England, yet the winter's cold is so intense, that not only the rivers, canals, &c. are locked up

up with ice, but even the great bay of the sea called the Zuyder Zee, is itself frequently frozen over.

In such a country no hills can be expected; but in the eastern parts a few gentle swellings of the surface serve to vary the prospect.

One of the principal rivers of Europe, the Rhine, terminates its course in Holland, but receiving in the heart of the country the Maas, or Meuse, which runs northernly from France, this much inferior stream usurps the name, and their common discharge into the sea below Rotterdam is called the Mouth of the Meuse. The Leck and the Wahal are branches of the Rhine uniting with the Meuse. The other rivers are of little importance in a geographical point of view, but with the multitude of canals by which Holland is intersected, are of incalculable value to the manufactures and commerce of the country.

The lakes of Holland are either stagnating inundations of the rivers, or so connected with the sea as rather to resemble inlets from it than internal pieces of water.

From the nature of the country no minerals, even coal, can be looked for: the peat for fuel is the only substance drawn by industry from the bosom of the earth: but in sinking wells and digging deep in the marshes, sea-sand has been met with, and the trunks of trees, pointing eastward; proofs of the great changes Holland in the course of ages has undergone.

This country produces very little grain, but in recompense the pastures are excellent, supporting cows enough for the use of a very crowded population, and affording butter and cheese sufficient to supply an extensive exportation.

The animals of Holland are similar to those of England: but the stork, a common and protected bird in Holland, is a stranger to England. The coasts furnish abundance chiefly of flat-fish, such as turbot, plaice, &c: but the herrings, for curing which the Hollanders (or Dutch, as we call them) were

were once so renowned, were drawn from the northern coasts of Britain.

The very dense population has been already noticed; and the number of large towns full of people is equally extraordinary. The chief town of the whole country, and of the province of Holland in particular, is Amsterdam, seated at the bottom of the great inlet called the Zuyder Zee, which forms its port, formerly one of the most frequented in the world. The inhabitants have been reckoned 212,000. The streets of this and of most of the other towns of Holland are straight, well built, and clean, having in general a canal in the middle, and a quay on each side, where the vessels may lie before the merchants' doors. Leyden, a celebrated university, possesses about 50,000 people. Rotterdam, another much frequented port, contains about 48,000. Harlem, where the art of printing, if it was not invented, was at least very early practised, possesses 40,000 people. The Hague, although only considered as an open village, was the seat of government, and contains 36,000 inhabitants. Middelburg, the capital of the island of Zealand, a noted port, with 30,000 people. Utrecht, another celebrated university, has about 20,000.

The prevailing religious profession of Holland is the calvinistic form of protestantism, resembling the Church of Scotland: persons of other professions, particularly Roman catholics, are very numerous, and enjoy perfect liberty of conscience.

The seven united provinces were lately converted into a kingdom for Louis the brother of the emperor of France, with a council of state, consisting of thirteen members, and a legislative body, composed of thirty-eight members, elected by the different provinces or departments in proportion to their population.

VI.

GERMAN STATES.

The term *Germany* is applied by the English to a multitude of states of various degrees of extent, population, and importance, occupying the heart of Europe, extending about 600 English miles from the Baltic to the southern borders of Austria, and about 500 miles from the Rhine to the frontiers of Poland. This country we call *Germany*, from the *Germania* of the ancient Romans; but in the language of the country it is called *Deutschland*, or the country of the *Teutones*; and the inhabitants *Deutsch*, (pronounced like the English words *dyche* or *tyche*,) an appellation by us corrupted and improperly confined to the natives of Holland and the other United Provinces, whom we commonly call *Dutch*.

Germany being situated between the parallels of 46° and 54° of n. lat. the climate is in general temperate, although along the shores of the Baltic the cold is often severe; but in the middle and southern provinces the warmth is sufficient for maturing grapes and producing wines of good quality. The northern and western parts of the country are in general one vast sandy plain, little elevated above the sea; but in the eastern and southern parts are many tracts of hills and mountains, uniting by gradual succession to the lofty ranges of the Alps. The most northerly mountains of any note in Germany are, the Hartz, 40 miles south-east from Hanover, rising to the height of above 3000 feet. The Erzgeberg, a range separating Saxony from Bohemia, are more remarkable for their valuable mineral productions than for their elevation. In the south-west part of the country are a number of broad ranges of considerable height, called the Schwartzwald, that is to say, the Black Forest, a name probably

probably occasioned by the vast dark forests with which those mountains are in general covered. The northern slopes of the ranges of the Alps indicate, along the frontiers of Bavaria and Austria, the boundary between Germany and Italy. The Carpathian mountains, rising in the east of Germany, extend between Poland and Hungary.

Germany furnishes many noble rivers: the Danube, called in German the *Donau*, rising in Suabia, flows eastward for about 1300 miles, through Bavaria, Austria, Hungary, and Turkey, into the Black Sea, being navigable for about 1200 miles all the way from Ulm. The Rhine, although rising in the Swiss Alps, forms for many leagues the boundary between Germany and France, its course being about 600 miles into Holland, where its noble stream is dissipated, and arrives without a name in the sea. The Elbe, having its source in the mountains between Bohemia and Silesia, flows northwesterly for 500 miles, and discharges itself into the sea below Hamburg. The Oder, rising in the mountains of Moravia, falls into the Baltic below Stettin, after a northerly course of 360 miles. Other considerable rivers of Germany are the Ems and Weser, running by Emden and Bremen into the German ocean. The Mayne runs westward from the centre of Germany, and passing by Francfort, a handsome independent town, noted for its fairs, and containing 36,000 inhabitants, waters the vineyards of *Hocheim*, whence originally came the wine we call *Old Hock*, and, opposite to Mentz, unites with the Rhine, which higher up receives, on the same side, the Necker, a considerable stream from the Black Forest. The Danube in its course receives many rivers, chiefly from the southern mountains, as the Leck, which waters Augsburg, the Iser passing by Munich, and the Inn, which joins it at Passau, contributing a body of water scarcely less considerable than that of the Danube itself.

The northern parts of Germany present a few uninterest-

ing lakes, but in the mountainous districts of the south are several of considerable magnitude. The lake of Constance, in the south-west, properly belongs to Switzerland.

Many forests of vast extent, chiefly of oak, are scattered over Germany, vestiges of those for which it was noted in ancient times.

From the present fluctuating situation of affairs in Germany, it is impossible at this time (1808) to point out with precision the limits, the population, or the resourses of the several states into which that country is divided: in the following statement, therefore, it is only meant to convey some notion of the principal divisions, as they stood a few years back.

Saxony contained about 11,680 square miles, and a population of 1,896,000: the chief towns are Dresden and Leipsig, the former with 50,000 inhabitants, and the latter with about 30,000: the country is fertile and well cultivated, producing grain, hops, flax, hemp, tobacco, and a little wine; with mines of silver, tin, copper, lead, iron, and coals. The prevailing religion is Lutheranism; and in Saxony the German language is spoken and written with greater purity and elegance than in any other portion of the country. Saxony is now erected into a kingdom.

Hanover contained about 8,224 square miles, and 850,000 inhabitants. Hanover, the principal town, possesses 15,000 people: Gottingen, a celebrated seat of learning, founded by George II. of Britain, contains about 7,600. The country is in general a sandy plain; but in the south are the Hartz mountains, already mentioned, producing some silver from mines supposed to be the most ancient of the north of Europe, having been worked in the year 968. Other mines afford copper, lead, and iron; marble, slate, limestone, and coal, are also met with in Hanover. The established religion is Lutheranism.

Hesse contained 2,760 square miles, and 750,000 inhabitants;

ants: the chief town, Cassel, about 22,000. The country is in general hilly, with a number of fertile valleys producing corn, pasture, and a little wine. Gold and silver have been found in the country of Hesse, with copper, lead, and coal. Lutheranism is the prevailing religious profession.

Mecklenburg, divided into two duchies, contained 4,800 square miles, and above 300,000 inhabitants: the country is sandy, with many lakes, marshes, and heaths, interspersed. The chief products are oats and rye, flax, hemp, cattle, wool, and timber. The religion is the Lutheran, and at Rostock is an university.

Brunswick.—This duchy contained 1472 square miles, and 170,000 people: the chief town, Brunswick, possessing 22,000. The country in appearance and productions resembles the other parts of Hanover, within which it is in a great measure inclosed. From the Lunenburg branch of the house of Brunswick the present royal family of Britain is descended.

In the north-west corner of Germany, but independent of any of the princes of that country, lies the great trading city *Hamburg*, containing about 100,000 inhabitants; on the north bank of the Elbe there very broad, but divided by several islands.

Lubeck.—Another considerable and independent trading town on the river Trave, which discharges itself into the Baltic, contains about 30,000 people.

Lubeck and Hamburg, in the year 1241, formed an agreement for the mutual protection of their commerce against pirates and robbers; and in the course of time many other cities of Germany, both maritime and inland, were united with them for the same purpose; whence arose the celebrated Hanseatic league, so called from the obsolete German term *hanse*, signifying an alliance or association.

Bavaria, a district extending 150 miles by 120, is watered

by

by the Danube, the Lech, the Iser, and the Inn. The country is in general plain, although there are considerable mountains in different quarters: it has been reckoned to possess a million and a half of inhabitants, and affords mines of silver, copper, and lead; but its greatest mineral treasures are the salt springs of Traunstein and Reichenthal. Munich, the capital, with a population of 38,000, is one of the handsomest towns in Germany, situated in a vast plain on the west side of the Iser. The religion of Bavaria is the Roman Catholic; and from being a duchy and electorate, this state has lately been erected into a kingdom.

Wurtemburg.—This duchy, now also become a kingdom, contained before its late accessions of territory, 3,200 square miles, and 600,000 people: it occupies the most considerable and the most productive part of Suabia, and the face of the country is agreeably and profitably diversified by the mountains of the Black Forest, and other districts. Grain of various sorts is produced in sufficient abundance to admit of exportation, and the banks of the Necker furnish very good wine. The mineral productions are silver, copper, lead, iron, sulphur, coal, and salt. The chief town is Stutgard, a good town: at Tubingen is an university; the established religion is Lutheranism.

Salzburg.—This country, formerly the archbishopric of Salzburg, contains about 2,880 square miles, with a population of 250,000. Being situated amongst the northern slopes of the Alps, it presents many lofty mountains and picturesque lakes, particularly that of Berchtoldsgaden, to the southward of the capital, Salzburg, a considerable town, with 20,000 inhabitants, pleasantly situated on the river Salza. This country furnishes mines of gold, silver, copper, and lead; and at Hallen are very valuable salt mines dug into the heart of a high hill, through which streams of water are conveyed, to be impregnated with the salt, which is afterwords crystalised by evaporation: warm mineral springs are likewise found in various parts. The Roman catholic is

the established religion; and by a late arrangement this ecclesiastic state has been secularised and united to Austria.

The sovereigns of the territories lying along the right or east bank of the Rhine, having formed themselves into a confederation, under the protection of France, the Emperor of Germany, Francis the II. in 1806 resigning all claim to that title, declared himself and his successors to be hereditary emperors of Austria; and lately sundry states in the north-western parts of the country have been drawn together to constitute the kingdom of Westphalia.

VII.

PRUSSIA.

Situation and extent.—This kingdom, which commenced only in the year 1707, and which had arisen to be one of the most considerable powers on the continent, is now, by the reverses of the late campaigns, reduced to a very feeble and precarious situation. In its prosperity, its greatest length along the Baltic was about 560 miles, and its greatest breadth about 300. Before the division of Poland, this kingdom, in all its parts, some of which are detached from the main body of the country, contained above five millions and a half of inhabitants; but including that of the Polish acquisitions, the whole population belonging to the crown of Prussia has been reckoned at above eight millions.

The capital of the Prussian dominions is Berlin, a very extensive and well-built town, but containing only about 140,000 people; it is situated on the river Spree, and fortified. Konigsberg, the principal town of Prussia Proper, is a noted sea-port on the river Pregel, near the Baltic, containing

containing upwards of 50,000 people: Breslau, the capital of Silesia, is a large and handsome town: Dantzick, once an independent city, is still a very considerable port on the Baltic, with 36,000 inhabitants: Potsdam, a modern town, of 26,000 people, is chiefly remarkable for the palace of the Prussian monarchs: Magdeburg, a strong town on the Elbe, contains 26,000 inhabitants: Stettin, a trading town, of 18,000 people, is situated on the Oder: Elbing contains 14,000, and carries on a considerable trade by the Baltic.

Climate and soil.—From its latitude and its situation along the south shores of the Baltic, and from the number of lakes, marshes, and forests, occurring in the northern parts of the Prussian dominions, the climate is generally moist and cold: those districts, however, which border the Austrian territories, are both more healthy and more fertile, while the environs of the metropolis itself present little besides barren sandy plains.

Mountains.—The whole Prussian dominions may be considered as one vast plain, excepting the southern parts of Silesia, where are ranges of hills rising to a considerable height, connected with the great chain of the Carpathian mountains.

Rivers.—The Elbe and the Oder have been already mentioned; but in the eastern parts of the kingdom flows the Vistula, which, after a course of 450 miles from the south-east, falls into the Baltic below Dantzic. The Pregel and the Memel are both very considerable streams.

Lakes.—Prussia presents many lakes, in general of little utility or beauty. At the mouths of the rivers Oder, Vistula, Pregel, and Memel, are a sort of lakes opening into the Baltic, but divided from it by long narrow slips of low land thrown up by the contrary action of these rivers and the sea.

Mineral productions.—In some parts of Silesia gold and silver have been found; but at present the mines of lead,

copper,

copper, and iron, are wrought to considerable advantage. Coal is also found in some hilly districts, with peat in the plains. On the shores of the Baltic, and even at a great depth under ground, in various parts of the Prussian dominions, are found quantities of amber, sufficient to produce an annual revenue of from four to five thousand pounds. This substance, which from the Arabians we call amber, was by the Greeks named *electron*; and from the property of giving light and attracting certain substances when it is rubbed and heated, is derived the general term *electricity*, now applied to similar powers in other bodies, by whatever mode these powers are excited.

Animals.—Prussia, in addition to the ordinary animals of Germany, is sometimes visited by the urus or wild cattle of the north: the lynx, the elk, the bear, are also not unknown; and sturgeon has been caught in the Oder.

Vegetable productions.—Forests are found in many parts of these dominions, particularly in Prussia Proper, in Silesia, and in the late acquisitions from Poland: the same provinces also furnish grain in abundance for exportation: tobacco has been long cultivated, and is now met with run wild in sundry districts.

The prevailing religion of the Prussian states is the protestant; but catholics are in some quarters very numerous, enjoying perfect liberty of conscience. The chief seminaries of education are the universities of Konigsberg and Francfort on the Oder.

Government.—The power of the Prussian monarch is unlimited by any senate or assembly of representatives of the people. The great object of the kings having been the formation of a numerous standing army, or rather a militia, every male was in fact born a soldier; but late experience has shown that, although by the exercise of military discipline in the hands of an absolute prince, vast armies may be formed and maintained, yet to communicate to them the

genuine spirit of patriotism, by which all their operations ought to be animated, is a task which no authority can accomplish.

VIII.

POLAND.

Situation and extent.—Although this once important and interesting portion of Europe be now erased from the catalogue of independent states, and parcelled out among its three powerful neighbours, professed friends and protectors, but in truth, as events have shown, its most decided foes:—although all this have happened, yet as, in the course of human affairs, Poland may one day resume her place among the nations, the following short account of the country, as it stood before its late total dismemberment, will not be unacceptable.

When entire Poland extended from the frontiers of the Prussian dominions to the river Nieper, above 600 miles, and from north to south about 420 miles, containing upwards of 220,000 square miles. The population of the country has never been well ascertained, but estimated at 12 millions: that of Warsaw, the capital, situated on the Vistula, is supposed to exceed 65,000: Cracow, formerly the capital, contains 24,000, and is likewise seated on the Vistula, but much nearer its source: Lemberg, or Leopol, has 20,000.

Climate and soil.—The air of Poland is various: in the northern parts, where there are many lakes and forests, it is cold, but not unhealthy; as it is also along the southern frontiers, where the lofty mountains retain the snow

through

through a great part of the year. The soil is in many places very fertile, and although agriculture be in a very unimproved state, yet vast supplies of grain are drawn from this country to other nations, as well by the Baltic as by inland communication.

Mountains.—Poland may be considered as one extensive plain, presenting few eminences of note; but the Carpathian mountains, which divide it from Hungary, are one of the great ranges of Europe.

Rivers.—The chief rivers of Poland have already been noticed in speaking of Russia and Prussia; for the Duna, the Memel, the Pregel, the Vistula, which discharge themselves into the Baltic, and the Niester, the Nieper, the Bog, which find their way into the Black Sea, although rising within the limits of Poland, pass into other dominions before they close their course.

Lakes.—Those in the western and northern parts are numerous, but not of great size: the lake of Gopler, on the west side of the Vistula, is 20 miles in length, on a medium breadth of 2 miles.

Mineral productions.—Mines of gold and silver were formerly opened in Poland; but of late only those of iron, lead, tin, and mercury, are worked: amber and coal are also found in certain places; but the richest mineral is the fossil salt produced in various quarters in the greatest abundance. Of the salt mines, the most celebrated are those of Wieliczka, a small town a few miles to the southward of Cracow: the mines are sunk deep in the ground, and traced out in various ramifications to a great extent, along the northern extremity of a branch of the Carpathian mountains; the salt is generally of a gray colour, intermingled with white cubes; large blocks are sometimes found inclosed in marl. Other mines are also worked some miles farther off from Cracow, in the same direction; but the salt is less pure than that of Wieliczka.

Animals.—Horned cattle and horses are reared in great numbers, and of valuable kinds: the elk, the bison or urus, a sort of wild cattle, the lynx, the wild goat, are frequently met with.

Vegetable productions.—Poland has long been noted for the quantities of grain it could afford to export; and the pastures are in many districts of great lūxuriance. The forests, of vast extent, consist of oak, beach, pine, and fir, of which great supplies are furnished by the ports on the Baltic, to other parts of Europe. These forests also abound with bees, from whose honey, besides what is exported, the liquor is made which we call mead, a name borrowed from the Polish word *miod*, signifying honey. Manna and kermes berries are likewise natives of this country.

Religion.—By the ancient constitution of the state, the Roman catholic religion was required to be professed by the king and his family, and was in fact the established system of the country; but Lutherans, Calvinists, and the members of the Greek church, were very numerous, and known by the common appellation of Dissidents. So many were the Jews, and so great were the privileges they enjoyed, that Poland was usually called the Hebrew Paradise: in 1752 they were estimated at upwards of two millions.

Government.—The whole states included under the general name of Poland, formed one republic, with an elective king at its head, but the power was vested in the senate, and the assemblies of the nobles. The king was elected by the spiritual and temporal counsellors of state, and by representatives from some of the principal cities of the kingdom. In proportion as the nobles were zealous in maintaining the privileges of their order against encroachments on the part of the king, with so much the greater severity did they trample on the peasantry and laborious part of the community, who were deprived of even the shadow of freedom.

dom. The last king of Poland, Stanislaus Augustus, with a spirit and with purposes worthy of better times and of a better fate, projected, with the approbation of the state, many admirable reforms in the government, by means of a new constitution, in which the crown was declared to be hereditary, but not in his own family, and the legislative authority was to be lodged, where alone it can legitimately be lodged, in senates consisting of representatives elected by the free and deliberate choice of those who were to be governed. Under the influence of such a constitution, Poland, abridged as its territory already was by the repeated usurpations of the neighbouring powers, who failed not to take advantage of the disorders incident to a state governed by an elective sovereign :— with such a constitution it was evident that Poland must speedily have resumed an importance in the balance of Europe to which she had long been a stranger. To crush, therefore, these hopes in the bud, the late monarchs of Russia, Austria, and Prussia, availing themselves of some pretended right to interfere in the interior arrangements of the state, invaded this devoted country, overpowered its gallant defenders, carried away the unfortunate Stanislaus into a foreign land, where his sorrows soon brought him to the grave, and finally, by an act of which these latter days, pregnant as they are with horrors, have furnished few examples, rent the kingdom into three portions, annexing to their own dominions that which was most conveniently situated for their purposes.

IX.

AUSTRIAN DOMINIONS.

Situation and extent.—These dominions, comprehending Bohemia, Moravia, Austria, Hungary, Transylvania, Istria, Croatia,

Croatia, &c. extend from west to east about 700 English miles, on a general breadth from north to south of about 350 miles, although towards the east the distance from the Danube to the northern extremity of the last acquisitions from Poland is about 420 miles. The House of Austria also possessed the Tyrol, on the north of Italy, and great part of Suabia, on the north of Switzerland; but by the peace of 1805, those countries were granted to other sovereigns. The name is a Latin imitation of the German term *Oestreich*, signifying, in allusion to the position of the country with respect to the other parts of Germany, the eastern territory.

Population.—From the various changes in the Austrian dominions, the population has been estimated by different writers from twenty to twenty-five millions. Vienna, the capital of the archduchy of Austria, as well as of the whole dominions of the Austrian Emperor, lies on the south bank of the Danube, in the midst of a fertile and well-cultivated plain. The ancient city is surrounded with fortifications, on the outside of which are erected the suburbs, much more extensive than the city itself, and likewise inclosed with works of defence: the population is reckoned at 254,000. Prague, the capital of the kingdom of Bohemia, seated on the Mulda, contains 80,000 inhabitants. Gratz, in Stiria, has 35,000; Presburg, the capital of the kingdom of Hungary, on the north bank of the Danube, 40 miles below Vienna, contains 27,000 people; but Buda, formerly considered the capital, has only 20,000, unless the population of Pest, on the opposite bank of the Danube, be included, when the amount will be towards 38,000. Hermanstadt, the chief town of Transylvania, contains about 17,000 inhabitants. The population of Cracow, the capital of that portion of Poland now annexed to Austria, was already mentioned in speaking of that kingdom. Trieste, the only sea-port belonging to Austria, seated in the north-east cor-

ner of the gulf of Venice, contains about 18,000 inhabitants.

Climate and soil.—These dominions, occupying the temperate region between latitude 45° and 52′, are in general healthy and agreeable, notwithstanding the ranges of mountains forming the northern and southern boundaries, and the marshy plains of Hungary. The soil is in most parts fertile, and in Austria particularly the comfortable appearance of the inhabitants proves at once the productiveness of the ground and the general happiness of their situation. The vast tracts of forest, marsh, and waste land, in the Polish acquisitions, present very different objects to the traveller, and in Hungary too much land seems to be abandoned to pasturage.

Mountains.—This country is much more varied in its surface than the northern or western parts of Germany. Bohemia is surrounded on all sides by hills, and the great chain of Krapak, called commonly the Carpathian mountains, forms the northern and eastern boundary of Hungary, which itself may be considered as one extensive plain. The south-westerly provinces of Carinthia, Carniola, Croatia, &c. present many mountainous tracts of very considerable elevation.

Rivers.—The Danube, which winds through the Austrian dominions for a space of 700 miles, has already been noticed. From the north it receives the Teiss, a very considerable stream, which, rising in the north-east corner of Hungary, flows in a semicircular bed through that kingdom, and, after a course of above 400 miles, joins the Danube at no great distance above Belgrade, seated near the influx of the Save, another large river, flowing from west to east, and dividing the Austrian from the Turkish dominions. The Drave also falls into the Danube on the south side, after a course of 350 miles from the eastern Alps. The Inn, formerly described, is now connected with Austria

for

for only a short distance, before its junction with the Danube, on the borders of Bavaria.

Lakes.—In these countries are many lakes, particularly in the western parts of Hungary, where that named the Platten Sea extends above 40 miles in length by 8 in breadth. In Carniola is the celebrated lake of Zirknitz, properly Zchernitz, about 8 miles in length by 4 in breath. In the beginning of summer the waters of this lake disappear through a number of openings in the bottom, which is covered with dry and rich herbage, until in September the waters return, spouting up with great force, from which circumstance the lake has its name, which, in the Slavonian language, signifies a fountain; and bringing great numbers of fish, many of which are left on the ground when the lake is again emptied in the ensuing summer.

Mineral productions.—The Austrian dominions are singularly rich in minerals: silver, a little gold, and tin, with lead, iron, sulphur, quicksilver, are found in Bohemia: Stiria furnishes excellent iron, lead, and coal: the iron mines of Carinthia are well-known, and the mines of Idria in Carniola have produced above 130 tons of mercury in one year. Hungary presents the rich gold mines of Cremnitz, with the silver mines of Shemnitz; and gold is found in abundance in the provinces of Transylvania and the Bannat. The salt mines in the neighbourhood of Cracow have been already noticed in speaking of Poland. The Austrian dominions also abound in mineral waters, of which those of Baden in Austria, and Carlsbad in Bohemia, are the most celebrated.

Animal and vegetable productions.—In addition to the animals common to the middle regions of Europe, these countries present the bison, bear, wild bear, wolf, and a species of beaver: the bustard and the pelican are not unknown. The horses of Hungary have long been renowned; but in fact that spirited race are not natives of that country, but drawn from other districts for the use of the

the army and the nobles. The sheep commonly resemble the Wallachian, remarkable for their erect twisted horns and long shaggy fleece. Forests are found in many districts, particularly in the late acquisitions from Poland. Besides abundance of various sorts of grain, hops, flax, and saffron, are produced; and among the wines of Europe, those of Tokay, the growth of the banks of the Teiss, in Hungary, hold a pre-eminent station.

Religion and government.—The prevalent religious system of the Austrian dominions is the Roman Catholic; but Protestants of different classes are very numerous in the various districts; in Hungary, particularly, they are reckoned to be equal in number to those of the church of Rome. The different portions of these states enjoy different privileges, Bohemia and Hungary being kingdoms, Austria an archduchy, &c: but since the assumption by the head of the House of Austria of the title of Emperor, the whole may be considered as forming an hereditary monarchy, limited, however, particularly in Hungary, by the authority of the assemblies of the states.

X.

FRANCE.

Situation and extent.—France, in its present enlarged form, is bounded on the north by a line still undefined from the Rhine to the mouth of the Scheld, the limit with the Dutch territory, by the German ocean and the English channel; on the west by the bay of Biscay; on the south by the Pyrenees and the Mediterranean; and on the east by the Alps, Mount Jura and the Rhine. In this state, besides the old kingdom, France comprehends the county of

Nice,

Nice, Savoy, the territory of Geneva, the Austrian Netherlands, and many other districts on the west side of the Rhine, formerly subjected to various sovereigns, ecclesiastic and civil. This great tract of country is situated between 42° 20′ and 51° 30′ of N. lat. and between 5° W and 8° 30′ of E. long. from Greenwich. The extent from the east end of the Pyrenees to the Dutch frontier, is about 550 geographic or 640 English miles, and that from the western extremity near Brest, to Strasburgh on the Rhine, is about 480 geographic or 560 English miles; the medium breadth, however, may be about 300 geographic or 350 English miles, consequently the superficial contents will be about 175,000 square geographic miles.

Population.—Whilst France remained a kingdom, the population was calculated at 24 millions, giving on an extent of about 140,000 square miles, 170 persons for each mile: but if, agreeably to the latest computations, the whole population amount to 32 millions, the average, including the very numerous inhabitants of Flanders and the other northern acquisitions, will amount to 182 persons for every square geographic mile.

Paris, the capital of the whole French dominions, is divided into two nearly equal parts by the river Seine, there navigable for barges of great burthen, and inclosing several islands, covered with buildings. On the largest of these islands was placed the ancient *Lutetia*, a city of the *Parisÿ*, from whom the present name of Paris was derived: a town of importance as early as in the time of Julius Cæsar's wars in Gaul. Paris is now of a circular form, compactly built of stone, with many magnificent edifices; but in general the streets are narrow and inconvenient, particularly in the centre of the town, where the population is extremely crowded; the new streets, however, towards the circumference of the circle, are broad and straight, but thinly peopled, owing to the space necessarily occupied by

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the extensive houses, gardens, offices, &c. of the principal persons of the country. Five-and-twenty years ago, in the best days of the royalty, Paris was reckoned to contain about 100,000 inhabitants less than London; but by an enumeration made in 1803, the population was found to be only 547,756. The stability of the government, however, and freedom from internal disorders, must speedily increase the number of inhabitants in that great city. Lyons was always considered as the second town in France, containing in 1762 above 115,800 people; but the outrages committed on that industrious and prosperous place during the revolution, have inflicted a wound on its population, activity, and commerce, not easily to be repaired. Marseilles and Bourdeaux, towns of great industry and trade, are supposed to contain each about 80,000 inhabitants: Brussels, once the capital of the Austrian Netherlands, now become a part of France, is a handsome town, with an equal population. The other principal towns of France are Lille, Ghent, Liege, Cologne, Coblentz, Mentz, Strasburg, Nantes, Rouen, Dijon, Orleans, Tours, Toulouse, Montpellier, Nismes, Geneva, of which the population varies from twenty-five to sixty thousand.

In the course of the late eventful revolution in France, a new division of the territory was adopted, by distributing the whole into *departments* of nearly equal extent, designated from some principal river, mountain, or other remarkable natural object within the bounds. This modern division being established by public authority, an acquaintance with it becomes necessary for understanding the history of transactions in France; for which reason, the following Table is annexed, pointing out the new divisions and the chief towns of each, together with the ancient provinces with which these new divisions are connected.

OLD FRANCE.

Ancient Provinces.	Departments.	Chief Towns.
Flanders (French)	The North	Lille
Artois	Straits of Calais	Arras
Picardy	Somme	Amiens
	Lower Seine	Rouen
	Calvados	Caen
Normandy	The Channel	Coutances
	Orne	Alençon
	Eure	Evreux
	Seine	PARIS
	Seine and Oise	Versailles
Isle of France	Oise	Beauvais
	Aisne	Laon
	Seine and Marne	Melun
	Marne	Chalons
	Ardennes	Mezieres
Champagne	Aube	Troyes
	Upper Marne	Chaumont
	Meuse	Bar on Ornain
	Moselle	Metz
Lorraine	Meurthe	Nancy
	Vosges	Epinal
Alsace	Upper Rhine	Colmar
	Lower Rhine	Strasburg
	Isle and Vilaine	Rennes
Britanny	Coasts of the North	St. Brieux
	Finisterre	Quimper
	Morbihan	Vannes
	Lower Loire	Nantes
Maine and Perche	Sarthe	Le Mans
	Mayenne	Laval
Anjou	Mayenne and Loire	Angers
Touraine	Indre and Loire	Tours
	Loiret	Orleans
Orleanois	Eure and Loire	Chartres
	Loire and Cher	Blois
Berry	Indre	Chateauroux
	Cher	Bourges

Nivernois

Ancient Provinces.	Departments.	Chief Towns.
Nivernois	Nievre	Nevers
Burgundy	Yonne	Auxerre
	Cote d'or	Dijon
	Saone and Loire	Macon
	Ain	Bourg
Franche Comté	Upper Saone	Vesoul
	Doubs	Besançon
	Jura	Lons le Saunier
Poitou	Vendee	Fontenay
	Two Sevres	Niort
	Vienn	Poictiers
La Marche	Upper Vienne	Limoges
	Creuze	Gueret
Limousin	Correze	Tulle
Bourbonnois	Allier	Moulins
Saintonge and Aunis	Lower Charente	Saintes
Angoumois	Charente	Angoulême
Auvergne	Puy de Dome	Clermont
	Cantal	St. Flour
Lyonnois, Forez, and Beaujolois	Rhone	Lyons
	Loire	Montbrison
	Isere	Grenoble
Dauphiny	Upper Alps	Gap
	Drome	Valence
Guienne and Gascony	Dordogne	Perigueux
	Gironde	Bourdeaux
	Lot and Garonne	Agen
	Lot	Cahors
	Aveyron	Rhodèz
	Gers	Auch
	The Landes	Mont de Marsan
	Upper Pyrenees	Tarbe
Béarn	Lower Pyrenees	Pau
Foix	Arriège	Tarascon
Roussillon	Eastern Pyrenees	Perpignan
Languedoc	Upper Garonne	Toulouse
	Aude	Carcassonne
	Tarn	Castres
	Gard	Nismes
	Lozere	Mende
	Ardeche	Privas
	Upper Loire	Le Puy
	Herault	Montpellier

Provence

Ancient Provinces.	Departments.	Chief Towns.
Provence	Mouths of the Rhone	Aix
	Lower Alps	Digne
	Var	Toulon

Countries united to France.

Ancient Provinces.	Departments.	Chief Towns.
Avignon & Venaissin	Vaucluse and Mouths of the Rhone	Avignon
District of Apt, Savoy, and County of Nice	Mont Blanc	Chambery
	Maritime Alps	Nice
Austrian Hainaut	Jemappes	Mons
Western part of Austrian Flanders	Lys	Bruges
Eastern parts of ditto	Scheld	Ghent
——————— Brabant	Two Nethes	Antwerp
Southern part of ditto	Dyle	Brussels
Part of Liege and Guelderland	Lower Meuse	Maestricht
————, Limburg, Stavelo, & Malmedy	Ourthe	Liege
County of Namur & duchy Luxemburg	Sambre & Meuse	Namur
	Forets	Luxemburg
Part of Archbishoprick of Treves	Rhine and Moselle	Coblentz
Part of Treves and Deux Ponts	Sarre	Treves
Part of Archbishoprick of Mentz and Deux Ponts	Mont Tonnere	Mentz
Part of Archbishoprick of Cologne, Juliers, Prussian Guelderland, Cleves, &c. &c.	Roer	Aix-la-Chapelle
Part of the territory of Geneva, Gex, Carouge, Thonon, &c.	Leman (Lake)	Geneva

The

The island of Corsica in the Mediterranean, has been likewise annexed to France, and divided into two departments, viz. that of the Golo, chief town Bastia; and that of the Liamone, chief town Ajaccio.

Climate and soil.—France occupies a very fortunate position on the globe; communicating with the German ocean on the north, with the Atlantic on the west, and with the Mediterranean on the south; the northern districts abounding in corn, the central in wine, and the southern in oil. The climate is generally pure and serene, although the rains are frequently of considerable duration, and some of the most fruitful tracts are exposed to destructive storms of hail. From its connection with the continent of Europe, the cold in Paris is not uncommonly more intense than that in London; but the mildness of the winter in Languedoc and Provence, along the shores of the Mediterranean, has long been celebrated as a resource for invalids from Britain, and other more northerly situations.

Mountains.—One of the features of France with which an Englishman is most struck is the succession of long gradual swellings in the face of the country, presenting an appearance very different from that of the frequent round knolls and little hills with which many parts of his own country, particularly Kent, is covered; and with the exception of a few mountainous tracts, France may be regarded as a vast extended plain.

The late acquisitions on the north-east contain many hilly tracts of moderate elevation; but the Vosges, separating Lorraine from Alsace, and the Jura range, forming the boundary with Switzerland, are considerable mountains. Towards the south of France are found sundry lofty summits, as the Puy de Sausi, the Plomb du Cantal, the Puy de Dome, of which the first is not less than 6,300 feet above the sea. In these and other eminences to the south and west of Clermont in Auvergne, mineral springs, basal-

tic

tic columns, regular conical hills, with depressions in the summit like the crater of Vesuvius, and other particulars, seem to indicate the former existence of volcanic fires.

The three eastern provinces, Savoy, Dauphiny, and Provence, are covered with hills and mountains: and to the first belongs Mont Blanc, the majestic sovereign not only of the Alps, but of all the mountains of Europe, towering with a broad summit covered with perpetual snow to a height little short of three English miles above the sea, and even 14,430 feet above the lake of Geneva, which winds round its base.

The Pyrenees, which divide France from Spain, extend for above 240 English miles from Cape Creuz, where they abut on the Mediterranean, to the angle of the Bay of Biscay near Bayonne. This range is broad and lofty, the highest point in the centre, Mont Perdu, being estimated at 1763 French toises, or about 11,380 English feet. A conical mountain, Canigou, attached to the north side of the Pyrenees, presents a noble object to the traveller on his way from Perpignan into Spain; but its elevation is only about 9200 English feet.

Rivers.—France is watered by many noble streams. The Scheld (in French Escaut) flows northerly, forming the port of Antwerp, and falls into the German ocean. The Sambre runs easterly to Namur, where it joins the Meuse, which, passing by Liege and Maestricht, unites with a branch of the Rhine, and falls into the sea below Rotterdam in Holland. The Moselle directs its course to the north-east by Metz and Treves, to be lost in the Rhine, at Coblentz. The Rhine itself, which forms the boundary between France and Germany, has already been described. The Rhone, rising in the Swiss Alps, traverses the lake of Geneva, and entering France, flows in a rapid stream south-westerly to Lyons, where it unites with the characteristically gentle Saone from the north, and then turning south, hurries along before

fore Vienne, Valence, Avignon, and Arles, to the Mediterranean, receiving from the Alps two powerful streams, the Isere and the Durance. The Garonne, rising in the centre of the Pyrenees, washes the walls of Toulouse, forms the noble harbour of Bourdeaux, receives several considerable rivers, as the Tarn, the Dordogne, &c. and after a course of about 250 miles, opens into the Bay of Biscay by a wide estuary commonly called the Gironde. The Loire rises in the mountains in the north of Languedoc, and flowing northerly to Orleans, then bends westward by Tours, and discharges itself into the Bay of Biscay, below Nantes; its whole course, in which it is increased by many tributary streams, as the Allier, the Cher, the Vienne, extends nearly to 500 miles: being, however, subject to floods, sandbanks are formed in its bed, which prevent vessels of burthen from proceeding but a few miles up from the sea. The Seine, springing from the heart of Burgundy, flows north-westerly for about 250 miles, into the English Channel, receiving in its way the Marne, the Oise, and other noticeable rivers, and passing through the centre of Paris, is of infinite service in transporting fire-wood, wine, corn, and many other articles of the first necessity, for the use of that great capital. Merchant ships of considerable burthen come up as high as Rouen, 40 miles from the sea; but at Havre de Grace the entrance is interrupted by a bar, over which even frigates cannot pass, excepting at spring tides.

Lakes.—France is remarkably deficient in lakes; for, excepting in the modern acquisitions towards the Alps, where are found the little lakes of Bourget and Annecy, and some diminutive pools in other mountainous districts, no lakes can be pointed out.

Mineral productions.—Gold has been discovered in the beds of certain streams; but silver is still found in Alsace. Britanny produces iron and lead, with some tin; and the former metal is likewise found in great abundance in many

other

other districts, as in Berry and the northern acquisitions; coal is also drawn from the mines of Flanders, and of the districts near the source of the Loire. The stone with which Paris is built is drawn from quarries excavated under the southern parts of the town itself; and the hill of Montmartre, which impends over the north quarter of the city, supplies abundance of gypsum, hence called by us *plaster of Paris.* The mineral waters of Barrèges and Bagnères on the northern slopes of the Pyrenees, of Plombières in Lorraine, of Bourbon in the centre of the country, have long been celebrated; and by the late extension of the territory, the waters of Aix-la-Chapelle, of Spa, of Aix in Savoy, are to be reckoned as appertaining to France.

Animals.—The horses of Normandy and the Limousin have long been esteemed; the first for draught, the last for the saddle: and great pains have of late years been bestowed to improve their breed, as well as that of sheep and horned cattle. In the tracts situated towards the Alps and the Pyrenees, the wolf and the bear are not uncommon; and the forests often present the wild boar. In the lofty mountains around Mont Blanc, the bouquetin or ibex, by some naturalists supposed to be original stock of the goat, and the chamois, a species of antelope, excite the perilous attacks of the hunter.

Vegetable productions.—Forests for timber and for fuel are found in many parts of France, and often of great extent: even at no great distance from Paris, the vast forests of St. Germain, Chantilly, Fontainbleau, Orleans, &c. present objects of great importance and value in themselves, as well as of much novelty to the English eye. France furnishes two vegetable productions unknown to England, wine and oil; the latter in the south-east corner, and the former distributed over many tracts of the centre and the south. The most esteemed wines are those of the banks of the Marne in Champagne, of the environs of Dijon in Burgundy,

Burgundy; of Côte-Rotie, Hermitage, &c. on the banks of the Rhone; of Lunel, Frontignac (properly Frontignan) in Languedoc; of the environs of Bourdeaux, called by us Claret. The celebrated brandies of Cognac on the Charente, and of Nantes on the Loire, are drawn from wines of great body, but not much in request for the table, on account of their general asperity. The oils of Provence have long enjoyed a high estimation, approaching the nearest to the delicacy of the Tuscan oils.

Islands.—To France now belongs the island of Corsica, which shall be noticed in speaking of Italy: and a few unimportant isles lie along the shores of the Mediterranean, as those of Hieres near Toulon; in the Bay of Biscay are found Oleron, Rhé, Belle-isle, with the isles of Oessant, corrupted by us into Ushant, lying out before the harbour of Brest.

Religion.—Although the Roman catholic persuasion be that of the great body of the people in France, yet the Calvinists, who were always numerous in the west and south, labouring, however, under heavy restraints, and the Lutherans of the northern districts, have of late years been placed perfectly on a level with the adherents of the church of Rome, with respect to every civil right and privilege; provision having even been made for the supposition of the emperor himself beinga non-catholic. The hierarchy of the church of Rome has been restored; but the extent of the several dioceses, parishes, &c. and the revenue of the several incumbents, have been regulated with a due regard to the station each is expected to maintain, and the duties he is required to perform. Measures have likewise been taken to remove certain distinctions which kept the Jews, who are numerous in the north-eastern parts of France, aloof from the common duties and interests of the state, under whose protection they prospered.

Government.—Agreeably to the latest constitution of the

French empire, the executive authority is lodged entirely in the will of the emperor, who likewise has alone the power of proposing laws to the legislative body, to be by them accepted or rejected by secret scrutiny or by ballot, and that without any discussion whatever. Part of this legislative body is renewed every year, on the nomination of the senate, from lists prepared by the elective assemblies of the departments. These elective assemblies are convoked and dissolved by the emperor, who also appoints their respective presidents. The members of the senate are likewise appointed by the imperial authority, and they are empowered to act as ministers as well as to hold other places of profit under the crown; but they can proceed to business only on the proposal of the emperor. To enter deeper into the theory of the government of France, would be to trespass on the bounds prescribed for the work: neither has that government yet become so stable, as to warrant any very precise delineation of its features being presented to the reader, with the prospect of a durable resemblance.

XI.

SWITZERLAND.

Situation and extent.—This very interesting country is bounded on the west by France, on the north and east by Germany, and on the south by Italy. It is situated between the parallels of north latitude 46° and 47°, 50′; and between east longitude 6° and 10°, 20′ from Greenwich: the greatest length from west to east being about 180 geographic miles, and the greatest breadth from north to south about 105 miles. Within these limits are included the

Valais,

Valais, the country of the Grisons, and some other little districts formerly considered as allies rather than as portions of Switzerland.

Population.—The whole inhabitants were, in 1801, reckoned to be nearly a million and a half. Basil, an ancient and celebrated town, situated on an elbow of the Rhine, where it commences its long course to the northward, is supposed to contain 14,000 people. Berne, distinguished for its neatness and the beauty of its situation, contains 13,000. Zurich, a large and industrious town, is situated at the lower end of a noble lake. Lausanne, a town of 9,000 inhabitants, is noted for its admirable position in the midst of the fertile and populous country of Vaud, and commanding a most extensive and magnificent prospect of the great lake of Geneva, the precipitous mountains on the opposite shore, and the snowy summit of Mont Blanc far overtopping all the neighbouring ridges. Other chief towns are Friburg and Schaffhausen, each containing 6,000 inhabitants; Lucern and Soleure containing 5,000. Geneva and its territory, once considered as an ally of Switzerland, are now united to France.

Climate and soil.—From the generally mountainous nature of this country, all gradations of climate in respect to heat and cold are experienced: the sheltered banks of the lake of Geneva furnish abundance of light pleasant wine, while the summits of many lofty mountains are covered with everlasting snow. The air, however, of the whole country is celebrated for its salubrity, and thither invalids repaired from many quarters of Europe, for the re-establishment of their health.

Besides the wines of the Pays de Vaud, of the banks of the lake of Neufchatel, of the environs of Basil, &c. considerable quantities of grain were raised in the plains of the western parts of the country; but the other districts, from their hilly and mountainous nature, were better adapted to the

the raising of cattle; and great industry as well as ingenuity was displayed by the Swiss in conducting rills of water along their mountain-sides, for the purpose of improving their pastures.

Mountains.—Switzerland presents within its bounds, and upon its borders, the most elevated mountains of Europe. Mont Blanc may not properly be considered as a Swiss mountain, but the Schreckhorn rises to the height of 11,500 English feet above the sea. The Yung-frauhorn, Titlis, Finsteraar, are even supposed considerably to exceed that elevation; and besides these lofty peaks, the general elevation of Switzerland is manifest when we observe that some of the greatest rivers of Europe, which discharge their waters into the Atlantic, the Black Sea, the gulf of Venice, and the Mediterranean, have their most distant springs in that country.

Rivers.—The Rhine, already mentioned as forming the boundary between France and Germany, rises in Mont St. Gothard, and runs north-easterly, near Coire, the capital of the Grison territory, into the lake of Constance; from which again issuing, it leads westerly to Schaffhausen, and a few miles below rushes over an inclined rocky precipice, forming a cascade of singular sublimity: thence passing through Basil, it begins its long northerly course to the sea. The Rhone, rising in the same Mont St. Gothard, at no great distance from the sources of the Rhine, follows a westerly course through the districts of the Valais, by the capital, Sion, to Martigny, where, bending to the northward, it is lost in the lake of Geneva; and at the other extremity issuing with rapidity through the middle of the town of that name, soon quits the bounds of Switzerland, and enters France. Not far from the springs of the Rhone and the Rhine, arises the Inn, which, after a long north-easterly course, falls into the Danube at Passau: and on the south side of the same mountains, begins the Tesino, one of the principal

principal contributors to the waters of the Po, which pervades the vast plains of Lombardy. The Aar, the Reuss, the Limmat, and many other considerable streams crossing Switzerland from south to north, enrich and adorn the country, and pour themselves into the Rhine, while the Rhône is indebted to none but a few temporary mountain-torrents for its stores.

Lakes.—The numberless rills and streams that rush down from the springs, rains, and melting snows, in the mountains, assemble at their feet, and fill the bottoms with water, forming lakes of great variety, in magnitude and beauty. In these lakes the earth, stones, trees, &c. hurried down by the torrents are deposited, and nothing but the pure element passes over at the lower end of the lakes, whence the Swiss rivers are distinguished for their crystal waves. To describe the lakes of Switzerland, would far exceed the bounds of this tract; the principal only can therefore be noticed. The lake of Geneva, otherwise called the lake of Lausanne, and now, by a revival of its ancient name, Lake Leman, is formed by the Rhone, and extends, in the shape of a bow, for about 50 geographic miles to Geneva, through the midst of which the Rhone again pursues its rapid course. The greatest breadth in the middle is about 12 miles, and its greatest depth 170 fathoms. Nothing can surpass the magnificence of the country by which this lake is inclosed; the lofty northern slopes, rich in corn and wine, and covered with towns, villages, farms, and country seats; towards the west and the south, the shores are low, fertile, and populous; but the eastern part is loaded with prodigious mountains, impending in many parts over the waters of the lake, so as to leave but a narrow horse-track along their base: of late, however, great exertions have been made by the French armies, to scoop out a road practicable for carriages and troops, to communicate with the pass of Simplon, in the Alps, leading

ing down into the Milanese in Italy. The only defect in the scenery of the lake of Geneva, is the total want of islands. The lake of Constance is a noble expanse of water, narrowed so much towards the west end, by projections of the land, as to be crossed by a bridge at the town of that name The upper and greater portion of the lake is in length about 37 miles, and in its greatest breadth about 15 : the lower portion is of much smaller dimensions. It contains several little inhabited islands, on one of which, near the upper end, stands the town of Lindaw. The banks of this lake are in general level and fertile, excepting at the head, where the Rhine breaks out from the mountains. The lake of Zurich is a beautiful crescent, about 25 miles long, by 3 broad, out of which flows the Limmat, through the middle of the town. Lucern is seated at the point where the Reuss issues from alake presenting, in its various winding shores and recesses, scenes which even in Switzerland are distinguished for boldness and picturesque effect. The lakes of Neufchatel and Bienne, at the foot of Mount Jura, are highly beautiful, but less grand and romantic.

Mineral productions.—Gold particles have been found in the beds of the rivers, and some silver, copper, and lead, have been discovered by mining: but the chief mineral treasure in Switzerland, is the fossile salt drawn from mines in the neighbourhood of Bex and Aigle, near the entrance of the Rhone into the lake of Geneva, which have long produced a considerable income to the canton of Berne, within which they are situated. Rock-crystal is found in the Alps in great quantities, and often in pieces of prodigious bulk. Mineral springs of various properties are found in several quarters of the country: the hot sulphurous waters of Baden, (the German word for a bath,) ten miles below Zurich, on the Limmat, are much frequented, and were celebrated in the time of the Romans, to whom they were known by the name of *Aquæ Helveticæ*. The warm

bath

baths of Leuk, in the Valais, are likewise much resorted to, for health and for amusement.

Animals.—Switzerland produces horses capable of undergoing great fatigue, and herds of excellent cattle. The rock goat, called in the German dialect the Stein bock, a name senselessly softened by the French into *bouquetin*, and affectedly adopted by some English writers; the chamois, the brown bear, the marmot, the vulture, are amongst the rarest animals of the country.

Vegetable productions.—Although Switzerland presents no tracts of forest to be compared with those of Germany, Poland, and Russia; yet the slopes of many of the mountains are clothed with woods, consisting chiefly of fir, larch, and pine; and water-saw-mills are to be seen in many places, to supply the inhabitants with plank and deal, for numberless purposes, the houses, in many districts, being entirely constructed of timber. From the elevation of the mountains, Switzerland possesses, in the different regions, plants the growth of the south of France, and of the north of Sweden; so that, excepting such as are natives of low marshy countries, the botanist may there discover a greater variety of vegetable productions than in any other tract of Europe, of much wider extent.

Religion and government.—The established religious profession is different in the different cantons or provinces of Switzerland. Those of Lucern, Uri, Schweitz, Underwald, Friburg, Soleure, and Zug, are Roman catholic, whilst those of Zurich, Bern, Basil, and Schaffhausen, are calvinistic-protestant. In the cantons of Glarus and Appenzel, both professions are established. Of the other states in the country, allies of the thirteen cantons, the Grisons are for the greater part calvinists, while in the Valais the inhabitants are now, generally, catholics: and the prince-abbot of St. Gall formerly ruled over a district of

which

which all the inhabitants are catholics, excepting those of the industrious town of that name, who are protestants, and independent on his authority.

By the constitution imposed by France on Switzerland in 1803, the country is now divided into the following nineteen cantons, arranged in the order of their population; viz, Bern, Zurich, Vaud, St. Gall, Argaw, Grisons, Tesino, Lucern, Turgaw, Friburg, Appenzel, Soleure, Basil, Schweitz, Glarus, Schaffhausen, Unterwald, Zug, and Uri. Of these cantons, the six first named, as being the most populous, send each two deputies, and each of the others, one deputy, to form the general diet, which meets yearly in the month of June, under a president or Landamman: but each canton is governed by its own peculiar councils and laws independent of the others.

XII.

PORTUGAL.

Situation and extent.—Portugal is situated between the parallels of 37° and 42°, of north latitude, being in length 300 geographic, or 350 English miles; but the breadth varies from 60 to 120 geographic, or 70 to 140 English miles: on the west and south, it is washed by the Atlantic, and on the north and east an imaginary line separates it from Spain.

Population.—The number of inhabitants in Portugal has been variously estimated from 1,800,000 to 2,300,000, the first indicating a population of 67, and the second of 80, to one square mile: no high rate for a country enjoying so many natural advantages.

Lisbon,

Lisbon, the capital, is finely situated on very uneven ground, on the north bank of the Tagus; which there spreading into a broad estuary, furnishes a capacious, safe, and much frequented haven. The town owes its principal improvements to the dreadful disasters produced by the memorable earthquake of 1755: the population is supposed to amount to 200,000. Oporto, whence is drawn the well known *Port* wine, is a considerable town of 30,000 inhabitants, seated on sloping ground on the north side of the Douro, about five miles above its mouth. Another harbour much frequented by foreigners is Setuval, commonly, but absurdly, called St. Ubes, the ancient name being *Cetobriga*: the town contains 12,000 inhabitants, engaged in the exportation of salt and other productions. Coimbra is a celebrated university; and Elvas is regarded as one of the keys of Portugal, on the Spanish frontiers.

Climate and soil.—Portugal enjoys a happy temperature, and the air of Lisbon has long been recommended for the restoration of consumptive, gouty, and other invalids from northern climates.

The face of the country is conveniently varied by hill and plain, and the soil would, if common industry were bestowed on it, be very productive; but agriculture is both ill understood and generally neglected.

Mountains.—Of these, there are in Portugal none of very noticeable elevations, although the whole frontier of Spain be carried across a very uneven tract. The range of Estrella, supposed to be the Mons Herminius, mentioned in the most ancient history of the country, extends from the Spanish borders in a south-west direction to the sea coast on the north of Lisbon.

Rivers and lakes.—The Tagus, which forms the haven of Lisbon; the Douro, which washes the walls of Oporto; the Guadiana, which, before it falls into the sea, forms for some time the boundary with Spain; and the Minho, (pronounced

 Minyo,)

Minyo,) on the northern frontier, belong properly to that country, and will be noticed in speaking of it. The Mondego, rising in the mountain of Estrella, passes by Coimbra, and falls into the Atlantic. Portugal affords no piece of water deserving the name of a lake: but some small pools are pointed out, as remarkable for their unfathomable depth.

Mineral productions.—The Tagus has of old been celebrated for its golden sands; and, under the dominion of the Romans, mines of gold and silver were wrought, of which considerable vestiges are still visible. Lead, tin, and iron, are also met with; and near Buarcos, on the west coast, a considerable coal mine is still open and productive. Mineral springs are found in various parts; those of Caldas da Rainha, and Chaves, are the most noted.

Animals.—Neither the horses, nor the mules, of Portugal, are equal to those of Spain; and the useful cow is rare from the want of natural, and neglect of artificial, pastures: the sheep are neither numerous nor esteemed; but the hogs furnish excellent bacon and hams.

Vegetable productions.—So much attention is given to the cultivation of the vine, to supply the northern nations of Europe, particularly England, with Port, Lisbon, and other wines, that the culture of corn has been neglected to such a degree, as to render importation constantly necessary. When apprehensions were entertained some years ago, that Spain or France would invade Portugal, the exportation to England of Oporto wine was extended even to the *vino do ramo*, or common weak beverage of the labouring people, so as to occasion a great outcry in the country, requiring the interference of government to put an end to the transaction: of this miserable juice of the grape, many hogsheads, however, arrived in England, and have since been converted into excellent old port of the most choice vintages. Oranges, lemons, and other fruits, the growth of similar climates,

climates, furnish both beauty and revenue, to this highly favoured kingdom.

Religion and government.—The Roman catholic religion, in its most rigid observance, is the only profession suffered in the Portuguese dominions; and the government is an hereditary absolute monarchy.

Islands.—Sixty miles to the northward of the mouth of the Tagus, and ten miles from the land, lies a cluster of small isles, called the Berlingas, but by our seamen the Burlings. To Portugal, also, belong a group of considerable islands, situated in the midst of the Atlantic ocean, between 38° and 40° of north latitude, and about 18° of longitude, west from the nearest land of any continent, which is the cape, called the Rock of Lisbon; a distance in that latitude of nearly 1000 geographic miles. These islands, usually called by us the *Western Islands*, a relative term, which, without a subject of reference, is devoid of meaning, were named by the first Portuguese settlers, about 1450, the *Azores*, from a species of hawks there observed in great numbers; but they are generally supposed to have been discovered by some Flemish navigators, at a much earlier period. These isles are Tercera, St. Michael, St. Mary, Graciosa, St. George, Pico, Fayal, Florez, and Corvo. St. Michael's isle is the largest, being 40 miles in length by 12 of mean breadth. In Pico is a volcanic conical mountain, rising about 7800 feet above the sea. Tercera, although not the largest, is considered as the principal isle, from which circumstance the whole group is often, but improperly, called the Terceras; the chief town of the island is Angra, a sea port: the general productions of the whole are, timber, wheat, wine, and fruit.

XIII.

SPAIN.

Situation and extent.—The great and important peninsula of Spain, (comprehending Portugal, naturally a portion of that country, and at various periods subjeet to the same sovereign,) is most advantageously situated between the Atlantic and the Mediterranean, commanding the narrow strait of Gibraltar, the only communication between those seas, and, in some respects, in the centre of the habitable globe. The extent in latitude is from the point of Tarifa, in the middle of the strait of Gibraltar, in 36°, 2′, to the point of Estaca in 43°, 48°, being, in fact, a few minutes more northerly than Cape Ortegal, hitherto considered as the most northern point of Spain. The distance, therefore, from south to north, is 466 geographic, or 538 English miles. The most westerly point of the peninsula is the head land called Cape Rocca, and by us the Rock of Lisbon, at the mouth of the Tagus, in longitude 9°, 35′, west from Greenwich; for the most advanced point of the promontory, called Cape Finisterre, at the north-west corner of Spain, is only in 9°, 13′, of west longitude. The most easterly point of the peninsula, which is Cape Creux, where the Pyrenees abut upon the Mediterranean, lies in 3°, 16′, of east longitude: the extent, therefore, between this point, and Cape Finisterre, is 12°, 29′, of longitude, equal, on the common parallel of 42°, to about 554 geographic, or 640 English miles; but the medium extent of the peninsula, from east to west, is only about 470 English miles.

Population.—The inhabitants of Spain are estimated at between eleven and twelve millions, a population seemingly very disproportionate to the extent and general productiveness of the country: the fact however is, that many parts

parts of the interior being destitute of rivers and springs, as in both Castiles, Arragon, &c. others being covered with broad chains of mountains, as the whole northern provinces, and some southern tracts in Grenada and Murcia, the nature of the country does not in its present state admit of a numerous population; but the sea coasts of Catalonia, Valencia, Murcia, and Andalusia, present scenes of rich fertility, active industry, and crowded population, of which, without ocular inspection, it is difficult to form a conception.

Madrid, the capital of Spain, contains about 165,000 inhabitants: it is situated on an elevated plain on the east bank of the little river Manzanares, which falls into the Tagus. The town is spacious and well built, the streets in general straight, wide, clean, and well lighted. The palace is a noble quadrangle of modern architecture, commanding an extensive prospect over the river and the opposite country. The environs of Madrid are dry and open, presenting few indications of the neighbourhood of the capital of the kingdom. Toledo, once the chief town of the country, but now much decayed, is romantically seated on a rock, nearly surrounded by the Tagus, and contains about 25,000 people. Barcelona, a rich trading port on the Mediterranean, contains 100,000 inhabitants; Saragossa, on the Ebro, about 40,000; Valencia, delightfully situated near the Mediterranean, contains about 70,000: Grenada, celebrated for the remains of Moorish magnificence, has a population of 80,000: Seville, an ancient city, contains about the same number: Cadiz, the grand resort of traders from all quarters, as well as the chief station of the navy, containing 70,000 people, is singularly situated at the extremity of a long sandy neck, inclosing one of the most commodious havens in Europe: Malaga, noted for the wines which grow in its neighbourhood, possesses a population of 40,000.

Climate and soil.—From its position on the globe the climate

climate of Spain must, in many parts, be supposed to be very warm, as indeed is the case, particularly in the tracts to the southward of the great range of hills called the Sierra Morena; but the snow lies on the hills which inclose Madrid on the north, for some months in winter.

Spain is most conveniently diversified by mountain and valley, hill and plain: the mountains extend, in general, from west to east; and the centre of the country is a vast elevated plain, giving rise to many noble rivers flowing to the Atlantic and the Mediterranean. The soil, in most places, where water can be procured for irrigation, produces abundantly every thing requisite for the subsistence and comfort of man: large quantities of corn are, however, regularly imported from Africa and other states on the Mediterranean.

Mountains.—The majestic Pyrenees, which divide Spain from France, have been already mentioned in speaking of the latter country; this chain, however, although usually described as terminating at the angle of the bay of Biscay, does not, in fact, approach that part of the sea, but continues its course, with diminished elevation indeed, parallel to the sea shore, all the way to the extremity at the Cape of Finisterre. Other chains, but of much less height, stretch across likewise from east to west, as the Sierra de Urbion, or mountains of Oca, on the north side of the Douro; the Sierra de Guadarama, which separates Old from New Castile; the mountains of Toledo, on the south of the Tagus; the Sierra Morena, the northern boundary of Andalusia; and the lofty mountains of Grenada, which, from their snowy summits, visible all the way from Gibraltar, are named the Sierra Nevada. In various parts are detached mountains of very considerable elevation, as Monserrat in Calalonia, of a singular conical form; the summit, composed of a number of slender pinnacles, shooting up to a great height, and crowned with hermitages; the whole a remarkable land-mark

mark for seamen, in making the port of Barcelona. The mountain, or rock as it is called, of Gibraltar, is a peninsula rising to the height of a quarter of a mile, and connected with the continent of Spain by a low, sandy isthmus, very little elevated above the sea.

Rivers.—Spain possesses many very noble rivers: the first in order, beginning in the north-east, is the Ebro, which, rising in the mountains of Asturia, flows south-easterly by Saragossa and Tortosa, into the Mediterranean, in a course of about 300 miles. The Xucar, rising in the southern parts of Arragon, discharges itself into the same sea, to the southward of Valencia. The Guadalquivir runs south-westerly 280 miles by Cordova and Seville into the Atlantic, on the north of the harbour of Cadiz. The Guadiana follows a course of 300 miles, in a parallel direction by Merida and Badajos, and coming on the borders of Portugal, bends southerly to the Atlantic. The Tagus, (in Spanish the Tajo, pronounced Taho,) the largest river in the peninsula, rises in the southern mountains of Arragon, and flowing west-south-west by the royal seat of Aranjuez, washes the walls of Toledo and Alcantara, and traversing Portugal, forms the haven of Lisbon, soon after which it is discharged into the sea, its whole course being about 420 miles. The Duero, (called in Portugal the Douro,) rising on the extremity of Old Castile, after a course in general to the westward, falls into the Atlantic below Oporto. The Minio, (or Minho of the Portuguese,) in the lower part of its course, is the northern boundary between Spain and Portugal.

Lakes—Spain presents no lakes deserving of notice:—that which gives rise to the Duero, in the mountains of Urbion, is a small but deep abyss; and the cluster of pools in La Mancha, called the Ojos, or Eyes of the Guadiana, are commonly supposed to be the original sources of that river.

 Mineral

Mineral productions.—From the earliest times, Spain was celebrated for its treasures of gold, silver, copper, and iron: the two former metals were chiefly found in the southern parts; and the Tagus was renowned for its golden sands; but since the discovery of the American mines no gold is now sought for; silver, however, is still extracted in certain parts of the mountains on the north of Andalusia. Towards the east end of the same range, are the rich quicksilver mines of Almaden, (a Moorish name for a mine,) of essential use in purifying the gold and silver ores of America. Copper, lead, and tin, are also found in various parts, and the iron of the northern provinces furnishes the material for the famous Spanish swords, gun-barrels, &c. So much superior to all other blades were those of ancient Spain, not only for their temper, but for their shape and manageableness, being short, double-edged, and sharp pointed, that the Romans themselves adopted them into common use, and by them became masters of the world. Coal is found in different parts of Arragon and Catalonia; and to a mixture of a fine red earth discovered in Murcia, the Spanish snuff owes some of its peculiar properties. Springs of mineral water are likewise to be met with in various quarters.

Animals.—The horses and the sheep of Spain have long been celebrated throughout Europe: the horses were probably much improved by the Saracens or Moors, during their long residence in the country; but the delicate fleeces of the sheep seem to be peculiar to this kingdom; and vast tracts of the Castilles and neighbouring provinces, (perhaps too many,) are set apart for their pasture and periodical migrations, from the north to the south in the autumn, and from the south to the north in the spring.

The mules of Spain are highly esteemed, and in fact perform every labour of draught or carriage: but many of these

these most serviceable creatures are yearly imported from the south of France, where numbers are raised for the Spanish market.

Vegetables.—From the great extent of this peninsula, its mountainous tracts, and long course of sea coast, the botanical riches of Spain are both very various and abundant. In the mountains, forests extend far and wide, filled with different kinds of the oak and the pine: the cork tree is a species of oak, called by the Romans *quercus*, and by the Spaniards *cuercho*, whence our *cork*. This tree possesses the singular property, that, when fifteen years old, the bark may be removed annually for seven or eight seasons in succession; the young bark growing up, and of itself throwing off that of the preceding year. Rosemary, hyssop, lavender, box, sage, wild thyme, perfume the air along the southern slopes of the Pyrenees; and on the dry hills of La Mancha, Murcia, &c. grows the *spartum* (*esparto* of Spain) mentioned by the ancients, and still employed in making ropes, baskets, and various other articles of the first necessity in common life; it resembles a short rush, but when steeped in water becomes pliable, and may be molded into all manner of forms. Maiz or Indian corn, and rice, are produced in certain districts, and the barley, much more nourishing than that of northern climates, is, when chopped down with the straw, the constant food of horse and mule all over Spain, under the name of *cebada*. On the Mediterranean coast are cultivated different kinds of *salsola* or glass-wort, which is burned, and from the ashes is extracted the alkaline salt called *barilla*, of great use in the manufacture of glass and soap. To recapitulate the varieties and properties of the different Spanish wines, would be a tedious task, as every quality may be found from the slender but lively *Val-de-penas*, the ordinary beverage of Madrid, up to the richest *Malaga*.

Religion and government.—The Roman catholic religion,

in the most rigid form, is alone professed, or even supposed to exist in Spain; and such is the wealth attached to the church, that the Archbishop of Toledo has been calculated to possess an income of upwards of £ 90,000. This vast income, however, is in a great measure nominal; for of late years it has been the practice of the government to burthen ecclesiastical benefices with pensions for various purposes, such as the opening of roads and bridges, erecting inns, supporting schools of different sorts, &c.; and it is but justice to the higher clergy of Spain, to record, that their general conduct and demeanour have in the eyes of foreigners, and those even of a different persuasion, appeared to be singularly decorous and exemplary.

The government is a monarchy, formerly much limited by the *Cortes*, or assemblies of the states of thedifferent provinces or kingdoms of which Spain consists; but these assemblies have seldom of late been held, the administration of affairs being carried on by the royal authority, through the intervention of various councils. The different provinces, however, still retain many valuable privileges, agreeably to their original constitutions, although now united under one and the same sovereign, no general union having ever been duly established.

Spanish Islands.

In the Mediterranean sea, opposite to the coasts of Catalonia and Valencia, lie the islands of Majorca, Minorca, Iviza, and Formentera, the two former having been known to the ancients by the name of the *Balearic*, and the two latter by the name of the *Pithyusan* isles.

Majorca.—This island, called by the Spaniards *Mallorca*, is, as its name imports, the largest of the Balearic: the greatest length is about 54 geographic miles, and the greatest breadth about 40 miles. The country is very mountainous, especially from the middle to the northern parts. It lies

lies between north latitude 39°, 15′, 45″, and 39°, 57′, 15″, and between east longitude 2°, 22′, and 2°, 47′. The capital, Palma, a considerable town and port, is situated on a fine bay in the south-west side of the island.

Minorca.—This island, the smallest Balearic, extends from west-north-west to east-south-east, for about 27 geographic miles, on a breadth in the middle of about 10 miles, and is situated between 39°, 47′, and 40°, 4′, 45″, of north latitude, and between 3°, 50′, 30′, and 4°, 23′, 53″, of east longitude. The island is, in general, of moderate elevation above the sea, and of an even surface; but in the middle is the remarkable conical hill of Toro, crowned with a convent. The capital, Ciudadela, is situated on a narrow haven at the north-west end of the island; but Port Mahon, at the opposite extremity, is one of the most spacious and secure harbours in the world.

Iviza.—This island, erroneously called by us *Ivica*, for the ancient name was *Ebusus*, is situated only about 40 miles from the coast of Spain, and extends from north-east to south-west about 12 miles, on a medium breadth of 10 miles: the land is equally divided into hill and valley: the principal town, of the same name with the island, lies on the south-west side. The chief production of the island is salt.

Formentera, formerly called *Ophiusa*, is small, and separated from the south shore of Iviza, by a channel 2½ miles in breadth: in size it is about 8 miles in length and breadth, and on the west side it possesses a convenient anchorage, called *Estancia*.

XIV.

ITALY, &c.

Situation and extent.—The northern parts of this celebrated and very interesting country are encircled by the

Alps,

Alps, extending from the Mediterranean at Nice round to the mountains bounding the bottom of the gulf of Venice. By the Alps Italy is separated from France, Switzerland, and Germany: on all other parts it is surrounded by the sea, stretching in a south-east direction from north latitude 46°, 40′, on the borders of Switzerland to Cape Spartivento, the southern extremity of Calabria, in latitude 37°, 50′, a distance of about 660 geographic or 760 English miles. The breadth is very unequal; the extent of the great plains of Piedmont, Lombardy, &c. from the Alps to the gulf of Venice, being about 220 geographic miles, while in Tuscany, the distance from sea to sea is only about 90 miles, in the centre of the Papal dominions about 120, and at the bay of Gaeta, towards Naples, about 70 miles.

Population.—The continent of Italy alone has been estimated to contain about 11,500,000 inhabitants, allotting 3,500,000 to the great plains watered by the Po, 3,000,000 to the central districts, and 5,000,000 to the kingdom of Naples. The northern division formerly comprehended a number of separate states subject to various sovereigns, such as Piedmont, belonging to the king of Sardinia; the republic of Genoa, the duchies of Milan, Mantua, &c. belonging to the emperor of Austria; the republic of Venice, the duchies of Parma and Modena, the territories of Ferrara, Bologna, &c. then a part of the Papal dominions. By late arrangements, however, Piedmont and Genoa are united to the French empire; and all the remaining divisions of the Lombard plains, including the Venetian dominions, have been formed into a new state, called the kingdom of Italy.

The chief towns of these extensive tracts are, Turin, a strong and very handsome city on the Po, containing about 80,000 people. Genoa, delightfully situated on a fine bay, and containing many magnificent buildings, is a place of great trade, with a population equal to that of Turin. Milan,

lan, a very large town, in the midst of a fertile and well cultivated plain, contains about 120,000 inhabitants, and is the capital of the new kingdom of Italy. Pavia, in the neighbourhood, is celebrated for its university. Mantua, in a strong position inclosed by a lake formed by the river Mincio, although much decayed from its former splendor, is a strong town, with about 12,000 people. Verona, noted for its amphitheatre and other vestiges of antiquity, Vicenza, distinguished for the buildings erected by the celebrated architect Palladio, and Padua, one of the most renowned universities in Europe, and near to which was born the Roman historian Livy, these towns were once the ornaments of the territory of Venice, a town in many respects without a parallel in the world. It is built on a cluster of islands, or rather mud-banks, on the verge of the Adriatic sea, three miles out from the land, and accessible only by boats; some of the channels between the islands are of sufficient depth to receive large vessels, but they are gradually shallowing. The churches and palaces of Venice present many admirable specimens of modern art, in architecture, sculpture, and painting: the population is estimated at 160,000. Parma, Modena, and Bologna are considerable towns, the latter containing about 60,000 inhabitants.

The centre division of Italy comprehended the republic of Lucca, a town of 25,000 people: the grand duchy of Tuscany, now called the kingdom of Etruria, the ancient name of the country, of which the capital is Florence, one of the most magnificent towns in Europe, in the midst of the rich and beautiful vale of the Arno, with a population of 80,000: Leghorn, (an absurd corruption of the genuine name *Livorno*, from the ancient *Portus Liburnus*,) is a strong and much frequented port belonging to Tuscany, containing upwards of 40,000 people: Pisa, once the head of a powerful commercial state, although now much decayed,

cayed, is still a large and well built town, with about 18,000 inhabitants.

In the centre of Italy lie also the Pope's dominions, or the ecclesiastical state, of which the chief town is ROME, once the mistress not only of all Italy, but of the greater part of the civilised world. This most interesting city occupied a number of small, low eminences, along the eastern bank of the Tyber, to which was added a large suburb on the opposite bank; the eminence where the famous capitol stood, is only 118 feet above the surface of the river. The circuit of the present walls, repaired and partly extended under the emperor Aurelian, towards the year 270, is about 13 English miles; but the town occupies now only about one-third of the inclosed space. The stupendous amphitheatre of Vespasian called the Coliseo, the theatres, temples, triumphal arches, historic columns, obelisks, the pyramid of Cestius, the sepulchral monuments, the public baths, the bridge, the aqueducts, and other vestiges of antiquity; the matchless fabric of St. Peter's, the other churches and palaces in which, until lately, were assembled the most valuable specimens of ancient sculpture, exhibiting, at the same time, the most masterly productions of modern times in every branch of the fine arts: —these, which barely to enumerate would require a volume, are some of the attractions presented to the scholar, the antiquary, and the connoisseur, in Rome and its immediate environs. By French invasions, and spoliation, many admirable statues and paintings have been withdrawn; but the antiquities, the classic ground on which it stands, the memory of heathen and of christian Rome, are immoveable, and must for ever command the attention and the respect of enlightened mankind. The population of Rome is computed to be about 162,000.

The southern portion of Italy is occupied by the kingdom of Naples, a tract supposed to contain about five millions

lions of inhabitants. Naples the capital is, after London and Paris, the most populous city in Europe, containing about 370,000; and is charmingly situated on the southern slope, and along the foot of a range of richly cultivated hills, commanding the view of a noble bay 15 miles in breadth, bounded on the east by Mount Vesuvius, on the south by the lofty picturesque mountains of Sorrento, and on the west by the islands of Capri, Ischia, Procida, &c. which separate this bay from the Mediterranean. The interior of Naples does not well correspond to the beauty of its exterior, the greater part of the streets being narrow, steep, and inconvenient; the environs, however, present objects of the most curious and interesting nature; the grand volcano of Vesuvius, whose slopes extend to the eastern parts of the town; the vestiges of *Pompeia* and *Herculanum*, buried ages ago, the former by the ashes, and the latter by the liquified metals discharged from that mountain; the volcanic ground on the westward of the town, presenting various mouths still throwing forth sulphureous vapours and streams of boiling water; the remains of Roman magnificence which once adorned the bay of Pozzuoli; the inexhaustible fertility of the surrounding country;—such are a few of the objects of instruction and curiosity, in addition to the monuments of modern art, and the antiquities drawn from the two ruined towns already mentioned, with which Naples furnishes the intelligent inquirer.

Of the other towns of this part of Italy, the most remarkable are Brindisi and Taranto: the former once a celebrated port on the gulf of Venice, but now much fallen off, its harbour never having recovered the injury sustained in the daring, although unsuccessful, attempt of Cæsar, to inclose within the town his rival Pompey: the latter, in early times, a match in power for Rome itself, but now limited to the surface of a small island, forming a secure

haven for coasting vessels in the deep recess of the southern extremity of Italy.

Climate and soil.—These, in a country of such extent in latitude, are naturally very various; but excepting in some low watery tracts, as towards the mouths of the Po, and the Arno, the Pontine marshes on the road between Rome and Naples, and some districts along the bottom of the Adriatic, the climate is mild and salubrious: even at Naples the heats of summer are tempered by the regular sea and land breezes which blow alternately during the day in that season.

Many parts of Italy have, from the earliest times, been celebrated for their fertility; and indeed nothing can exceed the productiveness of the vast plains extending along the Po, between the Alps and the Appennines. The vales and cultivated hills of Tuscany abound in every thing requisite for the comfort of the numerous inhabitants, whose appearance gave evident proofs of the solid and essential happiness of their situation under the late grand dukes of the House of Austria. Although the immediate environs of Rome present a scene of general neglect and depopulation, yet many parts of the papal territories, such as the districts of Bologna, &c. and the coasts of the Adriatic, are equally fertile, well cultivated, and well inhabited. The country round Naples was already noted for its singular riches in producing the most valuable crops; and the greater part of that finely situated kingdom waits only for the fostering care of the government to become, as in days of yore, a rich mine of vegetable wealth and human happiness.

Mountains.—The northern frontier of Italy is formed by the Alps, the most considerable range of mountains in Europe. They begin on the Mediterranean near Nice, and run northerly to the lofty summit of Mont Blanc, where

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turning eastward, they divide Italy from Germany, and bounding the bottom of the gulf of Venice, unite with a number of ranges extending into the dominions of Turkey. The height of Mont Blanc has been measured by various persons, and its perpendicular elevation above the sea has been found to be 15,662 feet English, or very nearly three miles. Another cluster of peaks to the eastward, called Monte Rosa, is estimated to be 15.000 in height. The Appennines branch off from the Alps behind Nice, and running eastward round the gulf of Genoa, continue their long course down the middle of Italy to the southern extremity of the peninsula of Calabria. These mountains are much inferior in elevation to the Alps; but some peaks are of considerable height; Monte Velino, in the heart of Italy, rising 8,397 feet above the sea. The most remarkable mountain of this country is, however, the celebrated volcano Vesuvius, of a conical shape, about 30 miles in circumference at the base, and rising nearly 4,000 feet above the sea: it stands detached from all other mountains, and by repeated eruptions has now encroached very considerably on the bay of Naples, its slopes extending quite to the end of the town. From the appearance of Vesuvius, it was probably, in former times, a cone of much greater magnitude, of which the summit, from the exhaustion of the materials within, had sunk down; and the present cone having been produced by successive discharges of rocks, ashes, and liquid *lava*, may in the course of ages increase, until it coincides with the remaining slopes of the original mountain, thus forming a cone of at least double the present elevation.

Rivers.—The Po, which waters the great plain of Lombardy, rises in the Alps, and running northerly to Turin, there begins its long eastern course to the Adriatic, receiving a number of smaller streams, of which on the north are the Tesino, the Adda, the Mincio, and on the south are

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the Tanaro, the Trebia, and the Panaro, the extent of the Po being about 300 English miles. The Adige, rising in the eastern Alps, flows through the Tyrol and the Vale of Trent, by Verona, into the Adriatic, a little to the northward of the mouths of the Po. The Arno, whose source is in the Appennines, waters the beautiful vale to which it gives name, passing by Arezzo, Florence, and Pisa, and is soon after lost in the Mediterranean. The celebrated Tyber, which likewise takes its rise in the Appennines, runs southerly through the heart of Italy, and dividing Rome into two unequal parts, discharges itself into the Mediterranean, by the two mouths of Ostia and Porto. The Garigliano, the ancient Liris, springing also from the Appennines, runs southerly into the bay of Gaeta. The Ofanto, formerly the Aufidus, springing in the same central range of mountains, passes by Canosa, waters the plains of *Cannæ*, memorable for the signal defeat of the Romans by Hannibal, and discharges itself into the Adriatic.

Lakes.—Italy presents many beautiful and interesting lakes: the *Lago Maggiore*, with its ornamented isles, the lake of Como, the ancient Larius, on the eastern bank of which are still shown the fountain and vestiges of the country seat belonging to, and finely described by Pliny, the lake of Garda, are all formed in the southern vallies of the Alps; the lake of Perugia, formerly noted under the name of *Thrasymene*, for the overthrow of the Romans by their great opponent Hannibal, is a fine piece of water situated in the bosom of the Appennines. The small lakes of Albano and Nemi, near Rome, appear to be the craters of ancient volcanoes.

Mineral productions.—Italy abounds with these of the most valuable sorts: the Alps furnish gold, copper, lead, and antimony: the Tuscan marbles have long been celebrated; and that of Carrara, on the east of the Genoese territory, is the best now known for the chisel of the statuary. Mi-

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neral springs of various properties are found in many parts of the country: those near Pisa have been renowned from the earliest times. The hot and sulphureous waters abounding in the vicinity of Naples and other places, evince the volcanic nature of the surrounding region.

Animals.—The plains of Milan and Lodi nourish herds of excellent cattle; and the cheese from the latter district, but known under the name of Parmesan, has long enjoyed a high reputation. Besides the common European animals of similar latitudes, in the marshes of the Tyber between Rome and the sea, and in other tracts of the same kind, are seen numbers of buffaloes, having a general resemblance to other horned cattle, and capable of supporting great fatigue; but their flesh is coarse, and the skin so strong as to afford the leather formerly used in armour, and from the name of the animal commonly called *buff.*

Vegetables.—From the great diversity of soil, situation, and temperature of Italy, its botanical treasures are very various and important. Besides the rich pastures of Lombardy, fields of excellent wheat and other grain, are there inclosed with rows of walnut, mulberry, and other fruit trees, with vines extending their branches in festoons from trunk to trunk. Rice and maiz or Indian corn, are also the growth of this highly favoured region; and in the environs of Naples, the productions of warm climates are found in great abundance and perfection.

The Falernian, Massic, and Cæcuban wines of ancient times are now but little esteemed, while those of other tracts, as of Tuscany, the slopes of Vesuvius, &c. are much in request: and the Florentine oils are preferred to those of any other country.

Italian Islands.

Corsica.—This island, now united to the French empire, lies in the angle between Italy and France, about

40 miles west from the former country, and 80 miles south east from the latter; it is of an oval form, the length from north to south being 90 miles, and the greatest breadth about 40. The island is very mountainous, but contains some fruitful vallies; and mines of silver, copper, lead, and iron, have been discovered. Monte Rotondo, in the centre of the island, rises to the height of about 9,000 English feet.

Corte, in a strong position in the heart of the country, was the former seat of government; but Bastia, on the east side of the island, and Ajaccio on the west, are now the chief towns, the population of the whole being calculated at 166,813 souls: the inhabitants, a hardy, warlike race, will long be remembered for their determined although unsuccessful struggle, under the patriotic *Paoli*, to vindicate their independence against the attacks of Genoa, supported by the best troops of France.

SARDINIA.—This island is separated from the south end of Corsica by a strait of only a few miles in breadth: its extent from north to south is about 140 miles, and the general breadth about 60 miles. Many of the mountains are so elevated as to be covered with snow for a great part of the year; but there are also wide vallies and extensive plains in the southern parts, which, with due care and cultivation, might be rendered very productive: corn, wine, oil, oranges, lemons, and dates, are, however, raised in considerable quantities. Silver, lead, granite, porphyry, are amongst the natural productions of Sardinia; and the fisheries on the coast, of tunny, sardinas, probably so named from this island, and anchovies, were once more valuable than in the present times. The inhabitants are very few proportionally to the extent of the country, being reckoned not to exceed 450,000. The capital, Cagliari, is situated on a fine bay, with a good harbour at the south end of the island.

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This island, alone, now remains to the king of Sardinia, of all his former dominions, once comprehending the fertile and populous country of Piedmont, Savoy, and other districts of less note, situated on both sides of the western Alps.

Sicily.—This noble island is of a triangular form, the north side extending from the strait of Messina westwards, about 160 geographic miles, the south side about 150 miles, and the east side about 120 miles. Sicily is separated from the continent of Italy by the strait of Messina, but a mile and a half over at the narrowest part, and is supposed to contain about a million of inhabitants. The capital of the island is Palermo, an ancient and handsome port on the north side, containing about 120,000 people. The other towns, once so celebrated in history, Messina, Syracuse, Agrigentum, &c. are now greatly decayed.

Sicily is most happily endowed with respect to climate, soil, and situation; but the desolating wars to which it has been exposed, and above all, the deplorable system of administration of public affairs, under which it has long been borne down, have converted this most valuable island, once the granary of Italy itself, comparatively into a desert.

The face of Sicily is agreeably and usefully diversified by mountain, hill, and valley: of the former, the most remarkable is Etna, or more properly Ætna, now called Monte Gibello, a volcano noted for its violent and destructive eruptions, from the most remote antiquity. This mountain rises to a height exceeding two English miles perpendicularly above the sea, and the circumference of its base is estimated at between 80 and 90 miles. The lower slopes are fertile, well cultivated, and populous; the superior region is clothed with forests, and the summit is covered with perpetual snows, in the midst of which is the great mouth, or crater, continually throwing out thick clouds of smoke; but the mouths whence have proceeded the latest

torrents of liquid fire, are situated much lower down the mountain: such, however, is the quantity of matter discharged from those mouths, that Catania, a town situated on the sea shore, at a distance of 30 miles, in following the tract of travellers, from the summit, has been frequently overwhelmed by the streams of *lava*.

Sicily presents no rivers or lakes of importance, but the natural productions of the surface, as well as of the bowels of the island, are highly important. The sugar-cane is of great antiquity in the country, and the fountain of the nymph Cyane, near the harbour of Syracuse, renowned in ancient fable for her earnest, but fruitless efforts, to rescue Proserpine from the arms of Pluto, who, through that fountain, carried his prize to the infernal domains,—this fountain produces in abundance the *papyrus*, supposed to be peculiar to Egypt, a reed once furnishing both the materials and the name to *paper*.

The established religion of this and all the isles, as well as of the continent of Italy, is the Roman catholic. The French forces having obtained possession of Naples, the king escaped to Sicily, which is now all that remains to him of the kingdom of the Two Sicilies.

MALTA, &c.—Malta, anciently *Melita*, and celebrated for the shipwreck of St. Paul, the scene being to this day pointed out by the natives, lies about 50 miles south from Sicily. It is in length about 20 miles, in breadth 12, and in circuit 50: the whole is one mass of very white stone, covered with a thin coating of soil: but from the copious dews and a certain moisture retained by the rock, the crops of grain, cotton, oranges, and other fruits, which are highly esteemed, are very productive; such, however, is the populousness of the island, that the corn is barely sufficient for the consumption of half the year. The cotton plant is sown in May and June, and reaped in October and November. The Maltese oranges are preferred to those of any

other

other part of Europe; and the sugarcane is successfully cultivated. The island is in many parts, particularly along the south side, bounded by inaccessible precipices, furnishing presumptive evidences that it has in former times been much more extensive than it is at present; and wherever access is at all practicable, deep entrenchments have been cut in the solid rock, which, together with the prodigious works constructed for the defence of the capital and its admirable harbours, render Malta next to impregnable, This capital called Valetta, to preserve the name and memory of the reigning grand-master by whose heroic exertions the island was triumphantly defended, in 1565, against the mighty force of the Turkish empire, is a very handsome town occupying a peninsula, separating the two harbours, and powerfully protecting the entrance of both. Malta is said to contain 60,000 inhabitants, independently of those of Goza and Cumino, two much smaller islands, adjoining it on the west.

The most ancient possessors of Malta, of whom we have any account, were the Carthaginians, or Punic colonists of Africa; and from them the ancient Punic language has been preserved, although with considerable intermixture of the Saracen, Norman, and Italian tongues, down to the present day.

The order of warriors, instituted in the beginning of the twelfth century for the defence of Jerusalem against the Saracens, were, in the progress of time, compelled to quit the Holyland, and retire to the island of Rhodes: but, in 1522, the Turks, after a most memorable siege, making themselves masters of that island, the knights were again forced to withdraw, and they remained in an unsettled state until 1530, when the emperor, Charles the Fifth, bestowed on them Malta, for the purpose of defending his Italian dominions against the assaults of the Turks, and other Mahometan powers. In this situation the knights

continued to the year 1799, when the French under Bonaparte gained possession of the island, which was, however, soon retaken by the English, who stipulated in the treaty of Amiens of 1802, that it should be restored to the knights: and the delays occasioned in the fulfilment of this part of the treaty furnished one reason for the renewal of hostilities between France and Britain, in 1803.

The other islands of importanee belonging to Italy, are those of *Lipari*, a singular voleanie groupe, on the north of Sicily; and *Elba*, on the Tusean eoast, noted for its inexhaustible treasures of excellent iron.

XV.

TURKEY IN EUROPE.

Situation and extent.—The European portion of the Turkish empire, is a vast peninsula, enelosed between the rivers Save and Danube, the Euxine, the Archipelago, the Mediterranean, and the Adriatic. It is true that on the north side of the Danube, between it and the Neister, are situated the valuable provinces of Wallachia, Bessarabia, and Moldavia; but from the recent inroads of the Russians, it seems little probable that these countries shall long form a part of the Turkish dominions. On the shores of the Adriatic, and along the eoasts of Greece, are also certain small districts and islands, formerly independent, or subject to the Venetians and Austrians, which will be afterwards pointed out.

Population.—The number of inhabitants, on the south of the Danube, has been computed to be 6,500,000, which, distributed over a tract of 150,000 square miles, will give only about 45 persons for each mile; a deficiency in some measure attributable to the extensive ranges of mountains, covering the northern and western provinces; but chiefly to

to the indolence, ignorance, and prejudices, civil and religious, of the inhabitants, and the wretched administration of public affairs; a system which, for many years back, has been conducted as if devastation and depopulation had been the main objects of its institution. Very recent attempts, however, to introduce European tactics, and other important approximations to the usages of their western neighbours, seem to evince a rising spirit of energy and improvement, which, if properly followed up, may one day restore the Turkish dominions to that station in the political scale of the world, which countries, once so celebrated, and naturally so important, ought to possess.

Constantinople, the capital of the Turkish empire, is delightfully and most advantageously situated at the point of union, between Europe and Asia, between the Euxine and the Mediterranean; thus pointed out by nature as the seat of commercial intercourse and dominion for half the globe. The city, including the suburbs on the opposite shores of the harbour, covers a vast extent of ground, and the population, even cleared of all idle exaggeration, is reckoned to exceed half a million. The streets are generally narrow, irregular and dirty, with wooden houses of no exterior magnificence. Many of the public buildings however deserve observation, particularly certain Mahometan temples, or *moskees*, the most remarkable, commonly called Santa Sophia, having been a Christian cathedral, erected by the emperor Justinian in the sixth century. The Turkish court is usually stiled the Ottoman or the Sublime Port, not as has been erroneously supposed from an allusion to the excellence of the *harbour* of Constantinople, [illegible] to the *gate* of the Seraglio or imperial palace, where, agreeably to ancient oriental custom, public business was transacted, and all orders, edicts, and laws, were promulgated. Adrianople, formerly the capital of European Turkey, is a spacious town, said to contain 100,000 people. Saloniki or Thessalonica,

a much-frequented port on the Archipelago, possesses 50,000. Larissa, now as of old the chief town of Thessaly, stands on the banks of the Peneus, a few miles above the romantic and delicious vale of Tempe, and on the northern borders of the wide plains of *Pharsalus*, where Cæsar evinced his consummate skill in the military art; having with an exhausted and dispirited army engaged defeated and utterly dispersed his foes, nearly twice his number, elated with recent success, most advantageously posted, commanded and encouraged, by Pompey and the chief nobles of Rome.

Athens, Corinth, Sparta, and the other cities of Greece, once so powerful and so splendid, are now chiefly known by the vestiges of their ancient magnificence; and of many even the position are no longer to be traced, the capital of the modern Morea or Peloponnesus, being Tripolizza, an inland town of no great antiquity.

The face of the country may in general be considered as mountainous; but in many districts are plains and vallies of great natural fertility: and the climate has always been esteemed healthy and agreeable.

Besides the Danube, which before its discharge into the Euxine, is in many places a mile in breadth, the northern parts of Turkey are watered by the Maritza, formerly the Hebrus, the Vardari or Axius, the Salambria or Peneus, falling into the Archipelago, by the Morava, the Drin, which unite with the Danube, and by another Drin, as well as some rapid streams pouring into the Adriatic: the rivers of Greece are more noted for their classical fame than their volume of water: nor are the lakes of Turkey either numerous or of great extent.

Mountains of very considerable elevation are frequent: the celebrated chains of Hæmus and Rhodope in the north; Pindus, Olympus, Ossa, Athos in the centre; and the rugged ridges of the Morea, are the most remarkable.

Gold,

Gold, silver, marble, were some of the precious mineral productions of this country; but the present occupiers pay little attention to such subjects: neither have travellers been able to afford much information respecting them, from the extreme difficulties experienced in visiting even the most civilized districts.

The gulf, separating Greece from Turkey in Asia, called the Archipelago, (an absurd corruption of the Italian terms Egio Pelago, that is, the Ægæan Sea,) is studded with isles of various sizes, but renowned in ancient fable and history: and on the western shores of Greece lie Zante, formerly Zacynthus, Cefalonia, formerly Cephalenia, and Corfu, the ancient Corcyra, producing excellent wine, oil, and fruits; and from Zante we draw the small grapes we call currants.

These three islands, with some others of less note, once belonging to Venice, were, on the fall of that state, erected by French influence into a separate republic.

On the eastern shore of the Adriatic is seated the active port of Ragusa, the head of a small independent territory inclosed by Turkey: the inhabitants are Christians, and the language and manners those of their opposite neighbours in Italy.

That part of Dalmatia subject to Venice, was lately transferred to Austria: the principal towns are Zara, anciently Jader, a fortress and sea-port, and Spalatro, remarkable for the vast remains of the magnificent palace, erected by Dioclesian, in the beginning of the fourth century; displayed to the world by the personal researches, and the splendid publication of the late eminent architect Robert Adam.

The Turks are strenuous professors of the religion of Mahomet: but of their European subjects it has been computed that two-thirds are Christians of the Greek church, with a portion of Armenians and Jews.

The Emperor, Sultan or Grand Signor is, agreeably to the

import

import of the Arabic term *Sultan*, an absolute and despotic prince, and limited in his government only by the doctrines and laws of Mahomet, from whom he claims his original descent.

ASIA.

This grand portion of the old continent is situated between the meridian of the mouth of the Hellespont on the Archipelago, in east longitude 26°, and that of the east cape on the strait separating Asia from America, in east longitude 190° or west longitude 170°. The most southerly point is the promontory of Malacca, in about north latitude 2°, and the most northerly is cape Taimura or Vostochnoi, in north latitude 77°. This wide extended quarter of the globe, therefore, comprehends every degree of temperature, and every variety of production, animal, vegetable, and mineral.

Turkey in Asia.—This part of the Turkish empire is situated on the south of the Euxine, on the east of the Archipelago on the north and east of the Mediterranean, and on the west of Persia. The extent is computed to be about 470,000 square miles; but from the number of sandy and mountainous deserts within its bounds, the supposed population of ten millions will give only 22 persons for each mile.

The most remarkable places in these countries are Aleppo, containing 250,000 inhabitants; Damascus, on the borders of the Great Desert, about 160,000; Smyrna, a noted port on the Archipelago, 120,000; Bassora or Basra, on the united river formed by the Euphrates and the Tigris, contains 50,000; and Jerusalem, once so justly venerable on many accounts, is now become a place of little consideration, subsisting chiefly by the interesting remains of its former importance.

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ASIA.
ARCTIC OCEAN
Artic Circle
EUROPE
RUSSIAN EMPIRE
TURKEY
BLACK SEA
CASPIAN SEA
PERSIA
ARABIA
HINDOSTAN
CHINESE EMPIRE
TIBET
CHINA
MONGOL
KALKAS
MANDSHURS
SEA OF JAPAN
JAPAN
SEA OF OKHOTSK
KAMTSCHATKA
PACIFIC OCEAN
Tropic of Cancer
YELLOW SEA
EASTERN SEA
Formosa
Canton
PEKIN
Nankin
Hainan
BIRMAN EMPIRE
BAY OF BENGAL
ARABIAN SEA
INDIAN OCEAN
EQUINOCTIAL LINE
AFRICA
RED SEA
CEYLON
Maldives
Laccadives
SUMATRA
MALACCA
BORNEO
JAVA
CELEBES
PHILIPPINE ISLES
Luzon
MAGINDANO
CHINA SEA
Gulf of Siam
CAROLINES
Ladrone Islands
Marian
PAPUA OR NEW GUINEA
New Hanover
New Ireland
Torres Strait
Cyprus
Aleppo
Bagdad
Bassora
Ispahan
Medina
Mecca
Sana
Mocha
Socotra
Bombay
Goa
Madras
Calcutta
Delhi
Agra
Lucknow
Cabul
Cashmere
Tobolsk
Tomsk
Irkutsk
L. Baikal
Samarcand
Bucharia
Little Bucharia
Desert of Cobi
Kokonor
Lassa
Aleutian Isles
Kurile Isles
Company's Land
Staten Isles
Leoo Keoo Isles
Bashee Is
Pelew Isles
Sumba
Timor
Amboyna
Gilolo
Saya de Malha
C. Delgado
C. Guardafui
C. Comorin
Colombo
Mahe Isles
Six Isles
Diego Garcia
East Long from London

The greater part of this country is covered with mountains, but the climate is genial, and the soil in general not unfruitful: so different however are the effects of the present and the former systems of government, that it is difficult to reconcile the history of its ancient with that of its present situation.

The lofty range of mountains, extending from the Euxine to the Caspian Sea, known to the ancients by the name of Caucasus; Mount Taurus, stretching from west to east the whole length of the country; and the chains of Lebanon or Libanus, and Antilibanus, running from north to south parallel to the shores of the Mediterranean, are the most remarkable eminences. The great rivers Euphrates and Tigris wash the eastern borders; and the celebrated Jordan, bounding Judæa on the east, is lost in the singular lake Asphaltites or the Dead Sea.

In the Archipelago and the Mediterranean, are many islands belonging to Asiatic Turkey, of which the chief are Mytilene, formerly Lesbos, Scio or Chios, noted for its wine, and Rhodes, once a powerful commercial republic. The great island of Crete, now called Candia, from the old capital, ought from its situation to be considered as belonging to Europe; it is in length 180 miles, but the general breadth is small: a chain of lofty mountains, the ancient Ida, where Jupiter was educated, occupies the centre of the island, but the sloping shores are fertile, and, under proper management, would be richly productive. Cyprus, lying on the Syrian coast, and in extent 160 miles by 70 where widest, enjoys a fruitful soil and delicious climate: such however is the state to which, by a tyrannical government it is now reduced, that the population is not estimated to exceed 50,000 souls; and although Cyprus wine still maintain its reputation at Venice, and in other parts bordering on the Mediterranean, the other productions, and even the air itself,

itself, are far from that degree of perfection which naturally they ought to possess.

Asiatic Russia.—The northern parts of Asia, from the parallel of 50°. is a portion of the vast Russian empire, or Siberia, divided into several provinces or governments, of which the most considerable are those of Tobolsk in the west, and Irkutsk on the east, so named from the capitals, the former containing 15,000, and the latter 12,000 inhabitants. The southern boundary of this prodigious tract of country, being in general a chain of lofty mountains, the cold natural to such a climate is much increased; and the northern parts bounded by the dreary Frozen Ocean, present only desert marshy plains, covered with perpetual ice and snow. The country is traversed by the mighty streams the Ob, the Yenisei, the Lena, the Amoor: and forests of pine, herds of cattle, mines of gold, silver, copper, iron and rock-salt, are the chief treasures of this region. The southwestern parts however washed by the Volga, and the Caspian, enjoy a fine climate, with a soil fertile in many valuable productions. Of these parts the capital is Astracan, a large and populous town of great trade, situated on a cluster of islands formed by the Volga at its entrance into the Caspian.

China.—This country, differing in many particulars from every other on the globe, so much so that with difficulty we credit the accounts given of it, by even the most judicious and accurate travellers, is situated between the parallels of 20° and 42° of N. Lat. and between the meridians of 100° and 121° E. Long. the length from N. to S. being about 1320 geographic or 1525 English miles, and the greatest breadth from W. to E. about 1239 geog. or 1445 English miles: but in these limits are not comprehended the vast tracts on the west and north of China Proper, which are subject to that country.

The population has, by the Chinese themselves, been carried

carried to the enormous number of 333 millions; by Europeans it has been estimated at from 210 to 220 millions: whichever of these accounts be the nearest to the truth, it is unquestionable that the whole country seems to swarm with inhabitants; and the number, magnitude, and populousness of the cities, towns, and villages, is without a parallel on the globe, unless Holland be considered as an exception. Pekin, the present capital of China, situated close on the northern frontiers, is supposed to contain 3 millions of people; while Nankin, the antient capital, is said to be still more considerable, the circumference of the walls being 17 English miles. Canton, situated on the eastern bank of a large navigable river in the southern parts of the empire, contains a million and a half of inhabitants, and is the great emporium of all European trade; the different nations having each their separate establishment or factory, where all business is transacted.

The greatest part of this wide empire is plain and level; the western and northern provinces, however, containing many mountainous ridges, which give rise to some of the greatest rivers in the old continent. The soil and climate are very various, but agriculture in all its branches is in general carried to a very great extent. The teas, the silks of China are too well known to require any description; and the mines of gold, silver, copper, iron, granite and marble, are of singular value. The metal we call tutenag, a native mixture of iron and zinc, is a peculiar production of China.

Amongst the singularities of this extraordinary part of the globe, is the great wall built along the northern frontiers, for the space of 1500 miles, being in many places 15 feet thick, and 25 feet high, with towers from distance to distance: It is supposed to have been constructed about 600 years ago. The lofty towers called by us Pagodas (of which we have a correct model in Kew Gardens) are a peculiar

culiar ornament to China: and the Porcelain or China ware has long maintained a superiority over that of all other countries: but this superiority consists rather in the purity of the materials employed than in the form, or the ornaments; in which points the establishments of Dresden, of Seve near Paris, &c. have a decided advantage.

The language of China differs from all others in this respect, that the original words consist only of one syllable, and these primitives are not very numerous, but by their combinations, and the various modes of sounding the component letters, a very copious language is produced. The written language has no alphabet, or series of symbols, or letters, which, by expressing simple sounds, may be combined together to express any complex sound, the Chinese having for each separate word, a separate mark, or character, amounting to upwards of eighty thousand; from which arises the extreme difficulty strangers, and even the natives themselves, meet with, in acquiring a competent skill in it.

INDIA, or HINDOOSTAN.—This next great portion of Asia consists chiefly of one wide peninsula, or rather promontory, confined between the river Indus on the west, and the Ganges on the east, the northern boundary being ranges of lofty mountains, from whence these rivers proceed. The extent between the mouths of the Indus and Ganges, is about 1200 geographic miles, and the distance from Cape Comarin to the northern mountains, is about 1500 geographic miles.

The climate, in this widely extended country, is, although various, very warm, notwithstanding the perpetual snows of the mountains on the northern frontier. The hot or dry season begins with March, and continues to June, when the rains commence and last till September: the remaining months of the year are generally pleasant, but the beginning of the year usually brings in a series of thick unhealthy fogs.

fogs. These periodical rains deluge the country and swell the rivers so, that the adjoining lands are inundated for a considerable extent on each side. In the latter end of July all the lower parts of Bengal contiguous to the Ganges and the Burrampooter, are overflowed, forming an inundation of more than a hundred miles in width; nothing appearing but villages and trees, excepting very rarely, the top of an elevated spot, the artificial mound of some deserted village, floating like an island.

The face of the country is very various, but in general it presents one extended plain; for the highest range of hills, those running south parallel to the western shore, called the Gauts, are not reckoned to exceed 3000 feet in elevation.

The rivers are numerous and considerable: the Ganges, which rising in the mountainous country of Tibet, and entering Hindoostan, flows in general south-easterly, receiving the tribute of many noble streams, discharges itself into the Bay of Bengal by a number of mouths, that on the west, which washes the walls of Calcutta, and that on the east which unites with the Burrampooter, being the most considerable. This last great stream is supposed to have its sources not very remote from those of the Ganges, but taking at first an opposite course, again winds to the westward, and joins the Ganges at no great distance up from the sea. The Indus or Sindeh, which forms the western boundary of India, rises in the same elevated country which sends forth the two rivers above mentioned, and flowing in general southerly, falls by several openings into the Indian Ocean. The Nerbudda, rising in the centre of the country, flows westerly into the Gulf of Cambaya, near Surat. The Godavery, following a parallel, but contrary direction, crosses the country eastward, which it enriches by its inundations, and discharges itself into the Bay of Bengal. The Kistna and the Caveri, which last incloses by

its arms the well known fortress of Seringapatam, also fall into the same bay.

The only mountains in India, if they may be so styled, are the ranges of hills stretching from north to south along the western shore, known in the country by the very improper name of the Gauts, a native term signifying not a mountain but a pass. The lofty ranges however which bound India on the north, are supposed to be the most elevated region on the face of the globe, that called Himmala (perhaps the Imaus of the antients) rising by observation 20,000 feet above the plain to the southward, itself elevated 5,000 feet above the sea.

Many of the natural productions of India are very valuable. The precious diamond of the greatest purity is only found in that quarter of the globe, in the neighbourhood of Golconda; those of Brasil in South America being of an inferior quality. The diamond is found in the beds of torrents, or in a yellowish earth, under rocks of quartz or sandstone: the usual shape being a six-sided prism, terminated at each end by a six-sided pyramid. The diamond is the hardest substance with which we are acquainted; and the conjecture of Sir Isaac Newton, founded on its great refracting power, that it was a combustible body, has of late years been fully confirmed by repeated experiments, diamonds having, when exposed to a very intense heat, been inflamed, entirely consumed and dissipated. Gold is found in the sands of some of the northern rivers: but silver is rare here as in most other eastern countries. Rice, which is the great article of food in India, maize and sugar-canes, are very abundant, and cotton furnishes employment to many of the natives in various branches of manufacture. The rich botanical treasures of India would require volumes to enumerate: the curious Banyan tree, or Indian fig, the cocoa-nut tree, the sago, and other varieties of the palm, are well known to Europeans; and the teek wood, so valuable

able for ship-building, has of late years been brought into very general use. Elephants, horses, cattle with a bunch on the shoulder, camels, the antelope known by the name of the nilgau, the royal tyger, such are a few of the quadrupeds of India.

The British possessions in India are chiefly the following: Bengal, Bahar, and Benares, on the Ganges, occupying a space of above 500 miles by 300, containing a native population of between ten and eleven millions. The capital of these tracts, and of the whole British dominions, is Calcutta, a large and populous town, containing about half a million of inhabitants, on the east bank of the western branch of the Ganges, about 100 miles from the sea; but the river is navigable up to the town for the largest vessels requisite in that country. Twenty-six miles above Calcutta, is Hoogly, an antient place which gives its name to that branch of the river. Patna, the chief town of Bahar lies, 400 miles higher up than Calcutta, and is the principal mart for saltpetre. Benares, 46 miles above Patna, is celebrated as the seat of the ancient learning of the Brahmins.

In the southern parts of the peninsula, the British possess Madras, or Fort St. George, containing, with the adjoining territory, about 80,000 natives, besides from 400 to 500 Europeans. On the western coast is Bombay, (so called by corruption from the Portuguese term signifying a good bay) situated on a small island containing the town and fortress, with a large dock and arsenal, and forming an excellent harbour. In the interior of the peninsula, lies Seringapatam, inclosed by two arms of the river Cavery, the former capital of the dominions of Tippoo.

Between the Ganges and China are a succession of separate states, viz. the Birman empire, separated by the Ganges, from the British possessions, comprehending Aracan and Pegu. The projecting peninsula of Malacca is the native country of the Malays, a singular race, whose language is so widely

widely disseminated over the eastern seas, and who by their activity, desperate valour, and peculiar arms, have long been the terror of the Indian seas. Farther to the eastward, lie the territories of the Siamese, the Cochin-Chinese, and the Tunquinese; these last in manners, and in the productions of their country, approaching their neighbours of China.

PERSIA.—This antient and celebrated portion of Asia is bounded on the east by the river Indus, on the south by the Indian Ocean, and that inlet of it called the Persian Gulf, on the west by an imaginary line separating it from the Turkish dominions, and on the north by the Caspian Sea, and the independent central states of Asia. Its extent from west to east is about 1200 miles, and from north to south about 1000 miles. The population has been estimated at ten millions, that of the capital, Ispahan, being reckoned at 600,000. This extensive city stands on a small river, in a plain enclosed by mountains, in the heart of the country. Other considerable towns are Shiraz, nearer the sea-coast, Derbent on the Caspian, Gombroon or Bender Abassi on the Persian Gulf, Cabul and Candahar in the north eastern quarter of the empire.

Persia is in general a very mountainous region: but there are various extensive plains, usually barren, sandy deserts; for the rivers being few, and of no great importance, even the vallies between the mountains require the hand of the husbandmen to refresh them with artificial streams for the purposes of agriculture. This is peculiarly necessary in the southern and central provinces: those bordering on the Caspian Sea are naturally more productive.

The Persian horses, although less swift, are taller and more graceful in their figure and motions than those of Arabia. The camels differ from the Arabian in having only one bunch, and are supposed to be the true dromedaries of the antients. In the northern provinces are found

a peculiar

a peculiar race of sheep, with broad massy tails weighing from twenty to thirty pounds: and in the western borders of the empire the formidable lion is found, who, with the tiger, the leopard, the panther, is frequently trained up and employed in hunting other animals.

The minerals of Persia are but little known: some silver, iron and copper, are, however, discovered. The Persian Gulf has long been famous for its pearl fishery, situated chiefly along the Arabic shore. Persia presents also springs of Naphtha, or pure rock-oil, on the western shores of the Caspian Sea. The earth about these springs has the property, that by taking up two or three inches of the surface, and applying a live coal, the part uncovered immediately takes fire, the flame however only heating but not consuming the soil. When the weather is thick and hazy the naphtha boils up to a greater height than when it is clear; and the oil often takes fire on the surface, running in a flame a considerable way to the sea. In the vicinity of these inflammatory springs are still found a few Parsees, or worshippers of fire, vestiges of a religious sect in antient times very numerous in the east.

The prevailing religion of Persia is a branch of Mahometism, differing in some respects from that professed in Turkey, which is one of the causes of the rooted enmity between those nations.

The Persian language is one of the most celebrated of the Asiatic, for strength, beauty and melody, and the literature of the country approaches nearer, in respect of solid sense and clearness of expression, to that of Europe, than any other of the east.

Of the monuments of antiquity still to be traced in Persia, the most remarkable are the magnificent remains of Persepolis, situated at the foot of a mountain, about forty miles north from Shiraz. The ruined columns, porticoes, halls, sculptures,

sculptures, inscriptions in a character hitherto unknown, cover a space of 600 paces by 390.

ARABIA.—This portion of Asia, much more celebrated than known, is a great peninsula washed on the east by the Persian Gulf, on the south by the Indian Ocean, on the west by the Red Sea, and connected with the Turkish dominions on the north by boundless tracts of barren desert. The extent may be taken at 1800 miles in length on a breadth of 800.

The greater part of Arabia consists of vast sandy tracts destitute of water, and consequently inhabited only by a few wandering tribes: along the coasts, however, where the vicinity of the sea produces rain, cultivation and population are carried to some extent. The only rivers deserving attention are the Euphrates and the Tigris (if these can be counted as Arabian rivers), which refresh the northern borders of this parched land; and of the mountains, which in various ranges traverse the country, the only one of celebrity is Mount Sinai, whence Moses promulgated the religious and political system of the Israelites, rearing its double summit to a considerable height, between the two horns of the Red Sea.

Arabia produces many valuable medicinal and aromatic plants and trees; and the coffee of this country, commonly called Mocca coffee, from the port where Europeans procure it, is esteemed the best in the world: at the same time it must be recollected that many precious gums and other productions of India and other eastern parts of Asia, having been brought to Europe through Arabia, they were erroneously believed to be the natural growth of that country.

The horses of Arabia have long been highly celebrated, and in the country their spirit, docility, speed, and power of enduring fatigue, are much more prized than any external qualification of size or beauty. The camel, or, as it is termed,

termed, by the Arabians, the ship of the desert, is of peculiar utility in traversing the dry and tractless wilds which cover the greater part of the country.

The principal towns of Arabia are Mecca and Medina: the former the birth-place of Mahomet, situated in a valley surrounded with hills, about thirty miles from the Red-sea; the latter, 200 miles to the north-west, is the place where his body is preserved; and from his flight to this city, about the year 622, the Mahometans reckon their time, calling that period the *Hegira*, an Arabic term signifying the flight. On the Red-sea are the towns of Jedda and Mocca, or Mocha, the former the port of Mecca, and the latter, with Maskat, the stations resorted to by European vessels.

TARTARY.—By this name it has been customary to distinguish the widely extended region occupying the central parts of Asia: the vulgar name is, however, improper, and ought to be written *Tatary*, and that of the people *Tatars*.

The portion of this region, which remains in a great measure independent on any foreign power, extends along the eastern shores of the Caspian sea, about 1500 miles from north to south, and 850 from west to east, comprehending wide tracts of barren desert.

The heats even of the southern parts are less violent than might be expected from their position in latitude, being tempered by the lofty snowy ridges forming the southern frontier. The country is in general mountainous, some ranges rising to a great height, the chief being that of Belur, covered with perpetual snow. To the eastward of this range stretches an immense elevated plain, or tract of table-land, the highest above the sea of any on the face of the globe, giving rise to many rivers of the first magnitude, which pervade the broad plains of Siberia, China, and India. Within this country are several considerable lakes,

particularly

particularly that called the sea of Aral, reported to have been once united with the Caspian.

Asiatic Islands.—Parallel to the eastern shores of Asia is a chain of extensive islands, the most southern of which form the empire of Japan. Of these the largest, Nipon, stretches from south-west to north-east, for about 750 English miles, but of very unequal breadth, being in some places 160, and in others not 30 miles across. Near the south-west end of this great island are two others much smaller, and on the north lies another of great extent called Jesso, subject to Japan, but inhabited by a rude, uncivilized race.

The population of Japan is unknown, but by the most accurate accounts of travellers the country swarms with inhabitants. The capital of the empire is Jedo situated on the east side of the great island, a town reported to occupy a space not less than 60 miles in circuit. Miaco another principal city in the interior of the same island is reckoned to contain upwards of 400,000 inhabitants. The only port in this empire to which foreigners are suffered to resort is Nagasaki in the south-west corner, near the island on which the Dutch have been allowed to establish a factory, and who with the Chinese are the only strangers with whom the Japanese carry on any trade.

The climate of this extensive empire, is subject to great variations from heat to cold, and the face of the country is in general mountainous. The soil is not of the best quality, but the industry and skill of the people have carried agriculture to high perfection.

Neither sheep nor goats, it is said, are reared in Japan, the silk and cotton abundantly supplying the place of wool. Horses, cattle, and swine, are also extremely rare, the Japanese living almost entirely on vegetables, fish, and fowl.

Gold and silver are found in great abundance, copper also is very common, but iron is scarce.

The

The Japanese worship a number of divinities subordinate to a supreme being; but their temples admit no image or idol. The government has this singularity, that there are in some sense two sovereigns, the one at the head of all spiritual, the other at the head of all temporal affairs.

Opposite to the countries situated between China and the Bay of Bengal, are a number of islands of various sizes, the most northerly are those belonging to Spain, called the Philippines, of which the largest, *Luzon*, about 500 miles in length by 100 in breadth, contains Manilla, a handsome fortified town, the station of the commerce carried on from Acapulco, in Spanish America.

Mindanao.—A large and beautiful island, also belonging to Spain, lies to the southward of Luzon.

Borneo.—This island, long considered the largest in the world, is cut into two nearly equal parts by the equator, and is about 660 geographic miles in extent from north to south, and about 540 from west to east. The interior of this great country is but little known: the far greater part of the shores, especially in the northern parts, consists of swamps, covered with forests extending many miles back. These flats are intersected by rivers dividing into numberless branches, which are the only passages into the country. The interior contains many lofty mountains, some of which are volcanic. Gold, diamonds, iron, tin, magnets, are some of the valuable productions of Borneo; abounding also in oxen, buffaloes, deer, goats, elephants, tigers, monkies, particularly that sort called orang-outang, the man of the woods; pepper, cloves, nutmegs, camphor, and other medicinal gums, rice, salt, sugar, are likewise the produce of this island.

The towns and villages along the sea-coast are usually built upon posts, to raise them above the annual inundations of the rains and rivers: and many are constructed on

rafts which rise and fall with the tide, and can be moved from place to place, for the conveniency of the inhabitants. Attempts have been made at different times by the Portuguese and the Dutch on the southern parts of Borneo, and by the English on the northern, to form establishments, but hitherto without success.

Celebes.—At no great distance eastward from Borneo, lies Celebes, an extensive island, deeply indented by several bays: its length from north to south is about 450 geographic miles, but the breadth varies from 300 to 60; the interior is covered with mountains, many of them volcanic, presenting scenery the most sublime and romantic. The chief productions are rice, cocoa, ebony, sanderswood, pepper, sugar, cotton, opium. The natives of this island are commonly called Macassars, from the name of a Dutch settlement near the south point. This race are noted all over the Asiatic seas, being fond of adventures and emigration, and capable of undertaking the most hazardous exploits: they are also named Buggesses, a term become equivalent to soldier in the European settlements in the east of India, as Seapoy is in the west.

Molucca, or Spice Islands.—Still farther eastward are situated a number of islands, some of them of small extent, known by the above names; these are, Ternate, Tidore, Gilolo, Ceram, Bouro, Amboyna, the Banda isles, &c. These last are very small but of great value, as the only country where the nutmeg grows in perfection. The nutmeg tree grows to the size of a pear tree, the leaves resembling those of the laurel, and it bears fruit from the age of ten to that of a hundred years. When ripe on the tree, the nutmeg has both a curious and a beautiful appearance: it is about the size of an apricot, and nearly of the same colour, with the same kind of hollow mark all round it, in shape it resembles a pear, and when perfectly ripe, the rind

rind over the mark opens and discovers the *mace*, of a deep red, growing over and in part covering the thin shell containing the *nutmeg*, which is black.

Amboyna is about 60 miles in length but narrow, being cut nearly into two parts by a deep bay. The face of the island is beautifully varied with woody mountains and cultivated vales. The great treasure of Amboyna is the clove tree, which grows to the height of forty or fifty feet, with spreading branches and long pointed leaves. In proper sheltered situations a tree will produce about thirty pounds weight of fruit every year, the crop being collected between November and February. This tree produces many branches, having at the extremities clusters of flowers, at first white, then green, lastly reddish and hard: when in this state they are what we call *cloves*, a name given from their resemblance to a thick short nail, in latin *clavus*. As they dry they become of a dark yellow, and when gathered of a deep brown. The flowers left on the tree grow to the thickness of an inch, and then dropping off produce new plants, which in eight or nine years begin to bear flowers.

To secure the sole possession of this precious tree, the Dutch, while masters of these islands, were in the practice of rooting out all clove trees but what grew in Amboyna, and even when the harvest was plentiful in that island, a part of the produce was destroyed.

Sumatra.—Opposite to the southernmost point of Asia, the promontory of Malacca, begins a long chain of islands bending in an arch to the eastward, and inclosing the islands already described. Of these, that at the western extremity is Sumatra, extending in length about 950 geographic miles, and at its greatest breadth about 180.

The island is divided in its whole length by ranges of lofty mountains, one of which, called Mount Ophir, rises nearly 14,000 feet above the sea. The principle article of trade with this country is pepper, on which account the English settlement

settlement at Bencoolen, on the southern side of the island, was established. This pepper is produced from a creeping plant resembling the vine; the white pepper is procured by stripping the ripe seeds of their outer husk. Camphor, cassia, cotton, are common: of the latter, one sort, called the silk cotton, is in its natural state peculiarly beautiful; but it is too short and brittle to be made into cloth. Gold, copper, iron, tin, rock chrystal, are found in Sumatra; as are the elephant, rhinoceros, buffaloe, tiger, porcupine, civet-cat, monkey; and the pheasant is there of singular beauty.

Banca.—On the east side of Sumatra, lies Banca, famous for its tin mines, discovered about a hundred years ago; the metal being of such a quality as to be preferred in China, where tin is much wanted, to that sent from England.

Java.—This is a very considerable island, extending in length about 650 miles; the breadth, however, varies from 60 to 100 miles; it is traversed from the one end to the other by a chain of mountains, but from its narrowness contains no river of importance: the sea coast is generally swampy, and extremely unhealthy. The products are pepper, indigo, sugar, tobacco, rice, coffee, and various fruits, the growth of a hot climate: gold has also been found here, but not in great quantities. The capital of the Dutch possessions in Java, and off all their Indian territories and colonies, is Batavia, situated on a bay at the west end of the island. The town is built in a marshy plain, on a river, which soon after falls into the bay; it is laid out in the manner of the towns of Holland, with canals in the middle of the streets, bordered with trees. It is fortified, and with the large suburbs and neighbouring district, is computed to contain about 120,000 inhabitants of all descriptions. The low marshy situation of this place, the stagnating waters of the river and the canals, joined to the uninterrupted sultry heats of the climate, render Batavia singularly unhealthy, particularly to Europeans. From another town, called

Bantam,

Bantam, in the west end of Java, were orignally brought the diminutive race of fowl known by that name.

Ceylon.—Opposite to the southern promontory of the great peninsula of India, lies Ceylon, an island of an oval form, about 240 geographic miles from north to south, and 130 from west to east where broadest. It is separated from the continent by a strait about 40 miles across, but full of rocky shoals, and impassable for large ships.

The eastern shores are high and bold with deep water, the northern and western parts of the island are low and flat, deeply indented by arms of the sea. The interior contains many lofty steep mountains covered with thick forests and impenetrable underwood, entirely in the possession of the natives, under the king of Candy, whose capital is situated amongst the fastnesses in the center of the country. The settlements formerly belonging to the Dutch, and now to the British, are confined to a narrow slip along the shore encompassing the island.

The seasons in Ceylon are more affected by the periodical winds or monsoons, then by the position of the sun; for although the island lies on the north side of the equator, the coolest weather is about the middle of summer, because then the western monsoon prevails; the spring begins in October, and the hottest season lasts from January to April: but along the sea coast in general, the heat is sensibly less than on the adjoining Indian continent.

The principal towns in the British possession are Columbo and Trincomalee; the former on the south-west coast is a regular fortress, with a large adjoining town, inhabited by natives and other Indians: the latter, a strong post on the north-east coast, commanding a spacious bay, forming by its different points and inlets, one of the best harbours in those seas. This harbour is one of the principal advantages possessed by Ceylon, being, together with Bombay on the opposite side of the peninsula of India, the only place

place of safety for vessels during the prevalence of the monsoons.

Ceylon produces many valuable vegetables; but the great treasure is the cinnamon-tree, which covers a plain of fifteen miles in length along the coast stretching south-east from Columbo. The best sort of cinnamon is the produce of a species of bay-tree, called *laurus cinnamomum*, the other spurious sort being procured from the *laurus cassia*. The true cinnamon has a large root, and divides into several branches covered with a bark, which on the outer side is of a grayish brown, and on the inner side of a reddish cast. The wood of the roots is hard and white, but without any peculiar smell or taste. The body of the tree, which grows to the height of 20 or 30 feet, is covered, as well as the numerous branches, with a bark at first green, but afterwards red. The leaf is longer and broader than that of the common bay: when first unfolded it is of a flame colour, but when some time exposed to the air, and dry, it changes to a deep green on the upper surface, and to a light green on the under face. The flowers are small and white, growing in large bunches at the extremity of the branches: they have an agreeable smell resembling that of the lily of the valley. The fruit resembles an acorn, but is smaller. This tree delights in a loose soil, with a warm exposure. What we call cinnamon is the under bark of this tree, separated from the rugged outer bark in the spring when the sap is abundant: it is cut into thin slices, and curls up by being dried in the sun In Ceylon the best bark is procured from trees of the age of three or four years. When the trunk has been stripped it affords no more bark; but the root sends out a number of young suckers. To be good, cinnamon ought to be of a fine grain, smooth, brittle, thin, of a yellow-colour, inclining to red, fragrant, aromatic, of a pungent but agreeable taste: the long slender pieces are most esteemed. The cinnamon we receive in Europe is frequently mixed

mixed with casssia bark, which may however be distinguished from it; for genuine cinnamon splinters in breaking, and has a roughness along with its aromatic flavour; while cassia breaks smooth, and has a mucilaginous or gummy taste.

The elephants of Ceylon are the largest animals of their kind: the oxen are small and distinguished by a bunch on the shoulder; these cattle when brought to England are improperly called buffaloes, which are much larger and stronger, and used in Ceylon in the room of oxen for labour. The anaconda, or *boa constrictor*, perhaps the largest of the serpent tribe, is not uncommon in the forests of Ceylon.

The great pearl-fishery is carried on chiefly in the bay of Condachy, on the west side of the island: the principal bank where the pearl-oysters are found, lies about twenty miles out from the land. The pearls are supposed to be in perfection in the course of seven years: the fishing commences in February, and ends in the beginning of April. The boats employed in this fishery generally contain 20 men, one half to row and the other half to dive and bring up the oysters from the bottom. The diver being accustomed to the exercise from his infancy, plunges into the water to depths of from four to ten fathoms, having a weight to accelerate his descent, and a net to collect the oysters, together with a rope connected with the boat, which he pulls as a signal to draw him up when he can no longer remain under water, which is usually about two minutes: instances have been known however of a diver continuing five minutes below the surface. An expert diver will make 40 or 50 plunges in a day, bringing up each time 80 or 100 oysters. When the oysters are brought on shore, they are placed by the different owners in small pits upon mats to keep them from the ground: there they die and putrify, after which they are easily opened without injuring the pearls. The pearls of Ceylon are of a whiter colour than

those

those of the Persian Gulf, but in other respects are not so much esteemed by the Asiatics, who prefer those of a yellowish or golden cast, while the Europeans choose the whitest.

New Holland, &c.—Adjacent to the south-east corner of Asia is situated a vast tract of country, to which we give the name of New Holland. This great island is situated between 11° and 39° of south latitude, and between 112°, 30′, and 153° of longitude east from Greenwich: the extent therefore from north to south is about 1680 geographic, or 1960 English miles, and that from west to east about 2220 geographic, or 2580 English miles.

Of the face of this extended tract little but detached parts of the sea coast have yet been explored: there the country is hilly, but not mountainous, partly covered with tall trees, free from underwood; many parts of the shores are swampy, and overrun with brush-wood.

The animals hitherto discovered in this county, in general partake much of the nature of the opossum or kangaroo, distinguished by a sort of pouch, formed by folds of the skin under the belly, where the young are suckled and cherished until they arrive at a due age and size. The common size of the kangaroo is that of a full grown sheep; the upper parts are small, but the lower are in proportion remarkably large; but the gradation is so elegant as to render this a very picturesque animal: the fore-legs are extremely short, but the hind legs are stout and long, serving to carry him along by long high bounding leaps, with considerable rapidity. Of the various birds met with in New Holland, a great number have the peculiar formation of the head and beak, observed in the parrot kind. The black swan, to find which was by the antients regarded as next to impossible, is by no means a rarity in New Holland.

Botany Bay, so named, from the number and variety of uncommon plants there discovered, is an inlet on the east side

AFRICA.
AZORES
WESTERN ISLES
SPAIN
Lisbon
Gibralter
STR. OF GIBRALTER
Tangier
Algiers
Oran
Tunis
Tripoli
Malta
Sicily
Sardinia
Majorca
ITALY
TURKEY
Smyrna
Antioch
Candia
Cyprus
Sidon
Jerusalem
Alexandria
Rosetta
Cairo
Suez
BARBARY
COUNTRY OF DATES
Morocco
Fez
Salee
Mogadore
Santa Cruz
CANARY ISLES
Teneriffe
Palma
Canary
C. Bojador
Madeira
Porto Sancto
Deserters
C. Blanco
Arguin I.
Portandik
Cape Verd
C. Verd
CAPE VERD
St. Jago
JALOFFS
FOOLAHS
FELOOPS
Gambia R.
Bissagos Is.
Serra Leona
Shoals of St. Ann
SAHARA OR GREAT DESART
Gualata
Tauden
TWAT
FEZZAN
Mourzouk
Agades
ASBEN
Tuggurt
Tombuctoo
SOUDAN OR NIGRITIA
WANGARA
BORNOU
Kong
Gago
Kashna
DAR KULLA
Bahr Kulla
DONGA
Mts. Al Komri or Mount. of the Moon
EGYPT
Thebes
Syene
Nubian Desert
DONGOLA
SENNAAR
Kordofan
Gondar
ABYSSINIA
Source of the Nile
ADEL
AJAN
MACHIDAS
Magadoxo
Brava
Melinda
Mombas
Zanzibar I.
Quiloa
MOZAMBIQUE
Mozambique
Sofala
Quilimane
Delagoa Bay
C. St. Mary
Port Natal
First P. of Natal
LIBYA
Desert of Barca
Derna
G. of Sidra
Medina
Mecca
Gidda
Yambo
Tropic of Cancer
ARABIA
RED SEA
C. Ras al Gat
Mocha
Hodeida
Bab al Mandeb
Socotra
C. Guardafui
C. Bassas
INDIAN OCEAN
Seychelles
Amirante
Mahe
MADAGASCAR
Port Dauphin
Mauritius or I. of France
Bourbon I. or Reunion
Bank of Nazareth
Cordogas
GUINEA
GUINEA
GULF OF GUINEA
IVORY COAST
GOLD COAST
GRAIN COAST
DAHOMEY
ASSHANTEE
BENIN
Benin
BIAFRA
Bight of Biafra
Old Calabar R.
Fernando Po
Princes I.
St. Thomas
Annabon I.
C. Lopez
CALBONGAS
EQUINOCTIAL LINE
LOANGO
Loango
CONGO
St. Salvador
ANGOLA
St. Paulo de Loando
Matamba
Old Benguela
St. Phillip de Benguela
BENGUELA
BEMBE
CIMBARRAS
C. Negro
C. Frio
Walwich Bay
Angra Pequena
Orange R.
C. Voltas
Colony of the Cape of Good Hope
Cape Town
Cape of Good Hope
Saldanna B.
Table B.
C. L'Agullas
Tropic of Capricorn
ATLANTIC OCEAN
Low Sandy I.
I. St. Matthew
Ascension I.
I. of St. Helena
Lake Maravi
Meridian 0 of London
West Longitude
East Longitude

side of the country, where the first British settlement was made in January 1788: but this spot being found less favourable than had been supposed, another settlement was begun twelve miles more to the northward, on an excellent harbour or bay, called Port Jackson, on the south side of which is a creek called Sydney Cove, where the colonists are now established.

The natives of this remote region seem to be but few in number, and in many respects are very little superior to the quadrupeds of the forest.

In the neighbourhood of New Holland lie clusters of islands, some of them of great size, such as Papua or New Guinea on the north, New Zealand on the south east, and Van Diemen's land, separated by a broad channel from the southern promontory. About 1000 miles to the eastward is situated the small but fertile settlement of Norfolk Island.

The vast Pacific Ocean extending between Asia and America is studded with multitudes of small isles, many of which are celebrated by the circumnavigators of the globe. Of these, Otaheite is well known, and Owhyhee, on the Sandwich groupe, is remarkable for the melancholy death of the ever-memorable Cook, in 1779.

AFRICA.

This quarter of the globe, much larger than Europe, and much smaller than Asia, is enclosed by the sea on every side, excepting where the isthmus of Suez, about 70 miles in breadth between the Mediterranean and the Red Sea, joins it to Asia. From the most northerly point on the Mediterranean opposite to Sardinia, to the southern extremity at the Cape of Good Hope, the extent in latitude is

 about

about 72 degrees, or 4320 geographic miles: the extent in longitude, on the parallel of 10 degrees N. is about 68 degrees, or 4,080 geographic miles. As Africa is cut nearly in the middle by the equator, the climate is in general very hot: but the southern promontory advancing far into the sea, and the cold of the antarctic pole being much more severe than that of the arctic pole, the heats in the district of the Cape of Good Hope are greatly allayed by the sea winds.

Of this very extensive portion of the world, although inhabited from the earliest antiquity, very little is yet known. The want of inland seas or great navigable rivers, the multitude of scorched barren deserts of boundless extent, the violent heats of the climate, the rude and often savage manners of the natives, have hitherto, excepting in a few instances, discouraged the boldest adventurers from attempting to penetrate the wide unknown tracts of internal Africa; nay, many very considerable portions of the sea-coast are still laid down in our maps rather from conjecture than from certain information.

Egypt.—This singular and long-celebrated country occupies the north-east corner of Africa; bounded on the north by the Mediterranean, and on the east by the Red Sea, or Arabian Gulf: on the west lie the barren deserts formerly known by the name of Libya. The only habitable and productive part of Egypt is a narrow level valley, watered by the river Nile, and bounded on each side by rugged ridges of rocks and mountains. From Syene, now called Assouan, down to Cairo, a distance of about 360 miles, the river flows through this narrow plain; but a few miles below that town, the rocky hills subsiding, the river diverges into two principal branches, spreading out as they approach the sea, and connected by a number of smaller collateral and parallel streams, watering and encircling a triangular

space

space or ground, which the ancients, from its general resemblance to the Greek letter Delta, usually called by that name.

One singularity of Egypt is the extreme dryness of the climate, rain being little known, excepting in the Delta along the Mediterranean: the great fertility of that district, and of the vale of the Nile, being chiefly owing to the regular inundations of that river, which, swelled by the rains falling in the interior of Africa, begins in May to rise in Egypt, and continues to the beginning of August, when it has increased 16 cubits above its ordinary height. Should the increase not come to the height until the middle of September, the country is exposed to the complicated evils of famine and pestilence. In addition to this inundation, in the summer months the dews fall so profusely as to supply the necessary food for vegetation. The periodical winds are another peculiarity of this country; blowing from June to September generally from the north: these winds were called by the ancients Etesian.

The chief city of modern Egypt is Cairo, situated a mile distant from the east bank of the Nile, and not far from the head or commencement of the great plain, or Delta. The streets are narrow, and through the principal one passes a broad canal, conveying water during the inundation from the river. On the rocky edge of a hill stands the castle, commanding a very extensive view of the town, the vale of the Nile, and the celebrated pyramids. The population is reckoned about 300,000, a number far exceeding that of any other town of Africa. Alexandria, occupying but a small portion of the ancient city of the same name, connected by a long bridge or causeway to the island once supporting the famous Pharos, a light-house which has given the name to many other similar structures, is conveniently situated between two harbours, or small bays, of

the

the Mediterranean, to the westward of the mouths of the Nile, and contains 15,000 inhabitants. Rosetta, on the western branch of that river, and Damietta on the eastern, both near the sea, are the only other places of note in the country.

Abyssinia.—Immediately to the south of Egypt lies a widely-extended country, called Nubia, covered in the greater part by barren deserts, but watered by the Nile: and adjoining it, still farther south, lies the kingdom of Abyssinia, extending from N. to S. about 660 geographic miles, on a mean breadth of about 500 miles. It touches the Red Sea on the east, but on all other sides is bounded by tracts of desert, or countries very little known. The capital of Abyssinia is Gondar, situated in lat. 12° 34′ N., on the top of a hill of considerable height, containing, in time of peace, about 10,000 families. The houses are chiefly of clay, with conical thatched roofs. The religion is the Christian, but strangely corrupted by many peculiar practices: the government is hereditary in the family of an absolute king. Abyssinia is one of the most mountainous countries in the world; the vales however afford a black fertile soil. The chief river is the eastern branch of the Nile, after a considerable course uniting with the western branch which comes from a more distant source in the unknown parts of internal Africa. Coffee, dates, tamarinds, are a few of the vegetable productions of this country. The horses are small but spirited: cattle and buffaloes are numerous, and the forests abound with the lion, the panther, the elephant, and the rhinoceros; the hyæna is so ferocious as to haunt the streets of the towns in the night: the crocodile and hippopotamus swarm in the lakes and rivers.

Tripoli.—In following the shores of the Mediterranean westward from Egypt, after a dreary tract of sandy desert, appears Tripoli, the capital of a Mahometan state. The town

town stands in a low situation on the sea, is thinly peopled, and fast tending to decay. The adjoining country produces olives, dates, and a little corn.

Tunis.—Still further westward is Tunis, the capital of a district formerly celebrated for its fertility. The people are considered as much more polished than any other Mahometans on that coast. The town, supposed to contain 50,000 people, stands on a lake at the bottom of a deep bay, a few miles from the vestiges of *Carthage*, once the industrious and prosperous seat of commerce, and long the formidable rival of Rome in its best days. The chief exports from this country are gold-dust, lead, oil, leather, wollen stuffs.

Algiers, or, as it ought to be written, *Alger*, the capital of an extensive region adjoining to the dominions of Tunis on the west, a noted port on the Mediterranean, is built on a hill, sloping down to the water, and contains about 50,000 inhabitants. The productions of this district are similar to those of Tunis.

Morocco.—This kingdom extends chiefly from the strait of Gibraltar along the Atlantic Ocean: the country is mountainous, the celebrated range of Mount Atlas there terminating on the sea, containing mines of iron and copper. The capital city, Morocco, stands in an extensive plain, shaded by palm and other trees, and watered by various streams from Mount Atlas. Other considerable towns are Fez, once the capital of an independent kingdom, Mequinez, Sallee, and Tangier, ports on the ocean. Fez furnishes the best red, and Morocco the best yellow, leather, known in Europe by the name of that place. The natural heat of the climate is in summer tempered by the cool winds from Mount Atlas, always covered with snow. The Moors of the towns are somewhat civilized, and the wandering Arabs of the interior are hospitable, but the *Brebers*, descendants from

from the original natives, who gave name to the country Barbary, are a fierce and unpolished race, occupying the fastnesses of the mountains, where they lead a life entirely independent.

The whole of this tract of Africa, extending between the Mediterranean and the pathless sandy deserts of the interior, was in former times remarkable for fertility, and in the hands of industry might still be rendered extremely productive.

Senegal and Gambia.—Proceeding down the western coast of Africa, after passing a long desert tract, appear the great rivers Senegal and Gambia, between which lies the most westerly point of Africa, Cape Verd, under which is the English isle of Goree. The principal productions of those parts are, the gum called Senegal from the name of the river, slaves, gold-dust, wax, ivory.

Sierra Leon, a settlement formed by Britons for the benevolent purpose of civilising the natives of that quarter of Africa, is situated towards the point where the coast turns eastward into the Gulf of Guinea.

Guinea.—Under this general name are contained different portions, called the Grain or Windward coast, the Ivory coast, and the Gold coast: the chief article of exportation by Europeans is slaves, for the cultivation of the American islands and other colonies, This trade commenced under the emperor Charles the Fifth, who in 1517, establishsd it at the instance of *Las Casas*, who accompanied Columbus in his discovery of America, and the very same person who, on his return to Europe, distinguished himself by the zeal with which he declaimed against the conduct of his companions towards theun offending natives of the new world. By a late act of the British parliament, the slave-trade, as far as Britons are concerned, is totally abolished.

Beyond Guinea the African coast turns southward, divided

vided into a number of states called Benin, Loango, Congo, where the Portuguese have long had some settlements; but very little is known respecting those tracts.

Cape of Good Hope.—It has been customary to regard this celebrated cape as the most southern point of Africa: this however is not the case, for about one hundred miles to the eastward, is a Cape, called corruptedly, Lagullas, or Needle Cape, at least 30 minutes more southerly.

Cape Town is situated in the bottom of a bay, opening to the north-west, called Table Bay, from a remarkable flat-topped mountain of that name in the vicinity. The town is large and well-built. The only landing-place is at a small wooden quay near the castle or fort, an extensive work, which with Fort Amsterdam, at the other end of the town, defends the harbour.

The territory belonging to the Dutch, when taken possession of by the British, extended about 500 geographic miles from W. to E., and about 200 from N. to S. The white inhabitants in the town and country were not estimated above 20,000. Great part of this territory is covered with ranges of rocky mountains and barren sandy deserts. Some mountains in the interior abound in excellent copper, and the botanical treasures are peculiarly valuable, many of the most curious and beautiful inhabitants of our hot and green-houses being brought from the Cape. On the south-east of the town are the vineyards which produce the celebrated Cape or Constantia wine, the product of vines originally carried thither by the Dutch from the banks of the Rhine and Burgundy. The natives of this corner of Africa are generally called Hottentots, a race differing in language and customs from all the neighbouring nations.

This southern extremity of Africa was first made known to Europeans by Bartholomew Diaz, who, by the orders of John the Second, King of Portugal, advanced so far on an expe-

dition to India by sea in 1486: but there meeting with tempestuous weather, he called the headland he had discovered, *Cabo tormentoso*, or Stormy cape, a name changed by John into that of *Good Hope*, from the expectations he now formed of complete success in his commercial and political projects. It was not however until the end of 1497, that Vasco de Gama, another Portuguese commander, actually turned the southern extremity of Africa, and after examining parts of the eastern coast, arrived, in May 1498, at Calicut, on the western shore of the peninsula of India.

In running northerly along the east coast of Africa, from the territory of the Cape of Good Hope to the entrance of the Red Sea, several states are found of which very little is known: the principal are Terra del Natal, Sabia, Sofala, Mozambico, Zanguebar containing the town of Melinda, Ajan and Adel, which borders on Abyssinia.

Of the interior parts of Africa little, comparatively speaking, is yet known; but from the published accounts of the intelligent and adventurous British travellers, Park, Hornemann, Browne, &c. very curious and important information may be procured respecting this interesting but hitherto undiscovered portion of the globe.

Madagascar.—Parallel to the eastern shores of South Africa, and at a distance of about 300 miles from the continent, lies the great island Madagascar, about 840 geographic miles in length, by above 200 in its mean breadth. A chain of mountains extends from the one end to the other, pouring down many streams, rendering it extremely fruitful in sugar-canes, cocoa-nuts, bananas, tobacco, indigo, pepper, amber, gums, with cattle, sheep, and buffaloes in abundance; but no horses, elephants, tigers, or lions.

Isle of France, &c.—To the eastward of Madagascar lie the Isles of France and Reunion, formerly Mauritius and Bourbon. The isle of France has a tolerable harbour, and produces

produces twice a year crops of wheat and Indian corn. The isle of Reunion contains a noted volcano, and affords sugar-canes, with abundance of cattle.

St. Helena.—This interesting and beautiful island was settled by the English in 1600: the principal place, James Town, is situated in S. lat. 15° 55′, and W. long. 5° 49′, about 1,200 geographic miles west from the nearest land of Africa. The greatest extent of the island is about 8 miles, and its circuit 20. The surface of the country is uneven and hilly, wooded, and exhibiting many vestiges of former volcanoes. The island is laid out in gardens and pastures. The town is situated in a deep valley upon the sea, affording the only practicable landing-place in all the island. The inhabitants are reckoned at 2,000, including 500 soldiers and 600 slaves. The surrounding sea abounds with whales, and a great variety of excellent fish for the table.

Cape Verd Islands.—About 500 miles west, a little northerly from Cape Verd on the African coast, lies a group of islands of the same name; they are ten in number, those of St. Jago and San Antonio being the largest. The air is hot and unhealthy, the soil is in general stoney and barren, the chief productions being salt and goat-skins; some of them, however, produce rice, lemons, oranges, cotton, and sugar. The chief town of St. Jago is a place of the same name with a bad harbour, for which reason vessels usually resort to Port Praya. Fogo, the Portuguese term for fire, is the name of one of these islands, so called from a remarkable volcano in the middle.

Canary Islands.—Between the parallels of 28° and 29° of N. latitude, and from 80 to 90 miles west from the coast of Africa, lies a cluster of islands belonging to Spain, extending from east to west, called in general the Canary Islands, from Canaria, the name of one of them. These are supposed to be the *Hesperides*, or the Fortunate Islands, of the antients: but they were long lost to the world, for

they seem to have been considered as a new country by Bethencourt, an officer in the service of Charles the Sixth of France, who, in 1402, arrived amongst them: the natives however could give no account of their origin; on the contrary, they had no idea that any other country existed.

These islands are twelve in number, of which the most remarkable is Teneriffe, so called from two native words, expressing a white mountain: and in fact this island presents a very lofty conical mountain called the Peak, crowned with perpetual snow, with a crater in the summit, from whence, in former times, have issued torrents of liquid matter and showers of ashes; and even at this day hot sulphureous vapours are continually emitted. These islands produce wheat and barley; but the famous Canary wine is chiefly drawn from Teneriffe and Palma, which also yield sugar. The chief town of these isles is Palma, in the island of Canaria, but Teneriffe is the most populous island.

Madeira.—This is the principal island of a cluster, situated in W. long. 16°, and between 32° and 33° of N. lat. about 300 miles from the nearest point of Africa. This island was named Madeira by the Portugueze, from the abundance of timber on it; but the want of timber is now a great defect. The island is in length about 54 miles, and in breadth about 20. The chief town is Funchal, with an open road for ships on the south side: the whole inhabitants are reckoned about 64,000. The interior of the country consists of ranges of lofty mountains, visible 50 miles off at sea. The grand production of Madeira is wine, of which the richest sort is called *Malmsey*, by a corruption of *Malvasia*, the name of the place in the island of Crete whence the vines were originally drawn. The vines are commonly supported on lattices made of reeds to prevent the grapes from resting on the ground; and to this precaution much of the excellency of the wine is ascribed. The chief trade of Madeira is with the English, who annually


NORTH AMERICA.
ASIA
East Cape
Bherings Strait
Icy Cape
Artic Circle
Nortons Sd.
Bristol Bay
ALASKA
Cook's Riv.
Volcano
Mt. St. Elias
Norfolk Sd.
Dixons Entrance
Q. Charlotte's I.
Q. Charlotte's Sd.
Nootka Sd.
Vancouvers I.
Supposed Str. of Juan de Fuca
R. Oregan
C. Lookout
Pt. Vancouver
C. Blanco
C. Mendocino
Port St. Franc. Drake
Monterrey
Pt. Conception
St. Barbara
St. Diego
Tropic of Cancer
Pt. Ano Nuevo
C. de St. Lucas
Shelvoes I.
Marias Is.
C. Corrientes
PACIFIC
OCEAN
The Sea seen by Mackenzie in 1789
The Sea seen by Hearne in 1771
Coppermine R.
Buffaloe L.
Slave L.
Athapescow
Ft. Chepawaya
Buffalo L.
Saskashawan
South Branch
MOUNTAINS
R. Columbia
G. of Georgia
Winnipeg
Cedar L.
Lake Superior
L. Huron
L. Michigan
L. Ontario
Falls of St. Anthony
Missouri
Mississippi
River
St. Fe
Leyza
NEW MEXICO
St. Felipe
Yamas
Rio
St. Paul
Texas
New Orleans
LOUISIANA
R. Colorado
Trinity R.
Red R.
Akansas
New Madrid
KENTUCKEY
Lexington
TENNESSE
N. CAROLINA
S. CAROLINA
GEORGIA
Charleston
Savanna
St. Augustine
E. FLORIDA
W. FLORIDA
Mouths of the Mississippi
GULF OF MEXICO
GULF of CALIFORNIA
CALIFORNIA
Culiacan
CULICAN
GUASTECA
Panuco
Mexico
Acapulco
Zacatula
Guaxaca
Bay of Tecoantepec
Pt. Remedias
St. Miguel
G. of Papagayo
Nicaragua
Truxillo
HONDURAS
C. Honduras
MOSQUITO SHORE
C. Gracias a Dios
Bluefields R.
St. Juan R.
Porto Bello
Carthagena
St. Martha
Maracaybo
Barcelona
SOUTH AMERICA
Trinidad
Tobago
Grenada
St. Vincent
St. Lucia
Barbadoes
Martinico
Dominica
Guadaloupe
Antigua
Barbuda
St. Kitts
St. Bartholomew
CARIBBEE Is.
CARIBBEAN SEA
Margarita
Curacao
Bonair
Porto Rico
St. Thomas
St. DOMINGO
JAMAICA
Kingston
CUBA
Havanna
Old Chan. of Bahama
BAHAMA ISLANDS
Eluthera
Guanahani
Long I.
Abaco
C. Sable
Campeche
B. of Campeche
Yucatan
C. Catoche
I. Cozumel
Bay of Honduras
HUDSONS BAY
Pt. Churchill
York Ft.
Severn Ho.
Albany Ft.
James's Bay
Moose Ft.
Chesterfields Int.
Wager R.
Repulse B.
Southampton
Mansel I.
Hudsons Str.
Resolution
Cumberland Str.
Frobishers Str.
Davis's Str.
Disco I.
BAFFINS BAY
Sir T. Smiths Sd.
Ald. Jones Sound
Sr. Jas. Lancasters Sd.
LONDON COAST
WEST GREENLAND
EAST GREENLAND
GREENLAND
C. Farewell
ICELAND
Skalholt
LABRADOR
Nain
Richmond Bay
C. Charles
Str. of Belleisle
NEWFOUNDLAND
St. Johns
C. Race
Placentia B.
Conception B.
GREAT BANK or NEWFOUNDLAND
GULF OF ST. LAWRENCE
Anticosti
Cape Breton
Louisburg
Gulf of Canso
Sable I.
NOVA SCOTIA
Halifax
C. Sable
NEW BRUNSWICK
CANADA
Quebec
Montreal
Ottawas Riv.
VERMONT
NEW ENGLAND
Portsmouth
Boston
C. Cod
Rhode Is.
NEW YORK
N. York
Albany
Long I.
PENNSYLVANIA
Philadelphia
JERSEY
Delaware B.
Baltimore
Chesapeak B.
WASHINGTON
VIRGINIA
Williamsburg
Halifax
Albemarle Sd.
C. Hatteras
Newbern
C. Lookout
Wilmington
UNITED STATES
ATLANTIC
OCEAN
140 Longitude West
130 from London

nually export from ten to twelve thousand pipes of wine; the remainder of the vintage, seven or eight thousand pipes, being consumed in the country.

AMERICA.

This grand division of the earth extends from the unknown regions in the vicinity of the North Poles, in latitude 70° to the outer extremity of *Terra del Fuego* in S. lat. 55°. 58′, a distance from N. to S. of 126°, or 7,560 geographic miles.

The discovery of this quarter of the globe is due to the celebrated *Christopher Colon, Colombo*, or, according to the Latin mode of expression, *Columbus*, believed to have been a native of the territory of Ferrara in Italy, but employed in the service of Genoa, from which circumstance he is usually called a Genoese.

According to the general opinion of geographers, Asia was extended eastward much beyond its true limits; so that the distance round to the western shores of Europe and Africa, was believed to be much less than it is in reality. This consideration, united with a number of detached observations, seeming to indicate the existence of land, within the reach of no long navigation to the westward of the old world, led Columbo to suppose, that by steering his course in that direction across the Atlantic ocean, he might open up a short and speedy conveyance to India and the other quarters of the east, from which vast treasures had for ages been brought over land to Europe. He submitted ineffectually his ideas and projects to the Genoese, to France, to England, to Portugal, at last Spain entering into his views, furnished him with a few ships, with which, sailing on the 3d of August 1492, and holding a course in general westerly

he

he on the 12th of the following October discovered Guanahani, or Cat island, one of the Bahama groupe in N. lat. 24° Long before this expedition, however, some of the northern parts of America were known to adventurers from Norway, who in the end of the tenth, and beginning of the eleventh centuries, seem to have visited the coasts of Greenland and Labrador, or Newfoundland.

In the year 1499, a Spanish officer, who had accompanied Colombo in his second voyage to America, was entrusted with a similar expedition, carrying with him *Americo Vespucci*, of Florence, a man of eminent nautical skill, who on his return to Europe, published an account of his discoveries, and to him, by a strange caprice, has been granted the privilege of conferring his name on the newly found vast western continent.

America is divided into two grand portions, the north and the south, connected together by a long irregular isthmus, in the narrowest place, not above 30 miles in breadth. The extent of North America from N. to S. between lat. 10° aud 70° is about 3,600 geographic miles, but that from the most westerly point on the narrow strait, separating it from Asia to the eastward, is somewhat greater.

From the variety of position in latitude, the climate of N. America comprehends every modification of temperature: in general, however, it has been observed, that the heat of summer, and the cold of winter, are much more intense than those of corresponding latitudes in the old continent. The sudden and violent transitions from the one extreme of temperature to the other, are another singularity of the American climate. The north west winds, passing over wide tracts of desert, lake, and forest, always produce the greatest cold.

As far as this part of the continent has been examined, there are no mountains to be compared in elevation with even those of Europe. The most remarkable chain, called the

the Apalachian mountains, running parallel to the eastern shore, rising probably in no part to the height of 7,000 feet.

A peculiar feature of N. America is the number and magnitude of the lakes, with which great part of the interior is covered in a chain extending from N. W. to S. E. Beginning at the S. E. extremity of the chain, these lakes are Ontario, Erie, Huron, Michigan, Superior, Winipec, Slave lake, &c. Lake Superior is not less than 350 miles in length, and 120 miles in its greatest breadth. The greater part of the shores is rocky and uneven; and the water is fresh and transparent: the principal fish are trout and sturgeon. It is remarkable that these lakes are never interrupted by ice, although the rivers to which they give rise are regularly frozen over in winter.

The rivers of N. America, are upon a large scale: that of St. Laurence, which serves to carry off the superabundant waters of lakes Superior, Huron, Michigan, Erie, and Ontario, flows in a north-westerly direction for 750 miles, being 90 miles broad at the discharge into the Atlantic, and navigable for ships of the line as high as Quebec, 400 miles up from the sea, where its channel is about five miles in breadth.

The river Mississippi, rising in the heart of the country, about lat. 47°, flows in general southerly to the Gulf of Mexico, in lat. 29°, a distance of 1,100 miles in a straight line, although by its windings the course really exceeds 1,400: but about towards the middle of its progress it receives on the west side, or rather it falls into another, the Missouri, a stream broader and deeper than itself, and of a much longer course, rising 2,500 miles N. W. from the junction. The mountainous tracts which send forth the Missouri, will doubtless, when the country comes to be better known, be found much more elevated above the sea than any other within the limits of N. America.

The

The Ohio, a gentle, transparent, and beautiful stream, falls into the Mississippi on the east side, after a winding course of about 1,200 miles.

The short river Niagara, discharging the waters of lake Erie into lake Ontario, presents one of the most remarkable cascades or falls on the face of the globe. This river issues on a breadth of 300 yards, and deep enough for vessels drawing nine or ten feet of water; but the current is so rapid and irregular, that only large boats (or *Batteaux*, as they are termed in the country) can venture to navigate it. Three miles above the falls, the stream begins to hurry down a rugged channel, utterly impassable, until at last, arriving at the brink of a precipice, it throws itself headlong to the bottom. The river does not however fall in one continued sheet of water, being divided by islands into three separate cascades. The most stupendous of these is that on the N. W. or Canadian side, called from its size, the Great, and from its form, the Horse-shoe fall: the height of this fall is about 142 feet, whereas the two others are each 160 feet in height. The breadth of this great fall is conjectured to be 600 yards; that of the island adjoining is 350 yards; the middle fall is only about 5 yards wide; the next island about 30; and the fall on the S. E. side is supposed to be about 350 yards in breadth: making the whole extent across the falls and islands, about 1,335 yards, or three quarters of an English mile. The body of water thrown over this tremendous precipice has been calculated to amount to above 670,000 tons in one minute.

British Possessions.—Of these, the first is order and importance, is Canada, lately divided into two provinces or governments, entitled from their local position, Lower and Upper Canada.

Lower Canada extends along the north bank of the river St. Lawrence, from its mouth to a point midway, between the town of Montreal and Lake Ontario, where begins the

boundary

boundary with Upper Canada, which runs in general northerly along a chain of small rivers and lakes to the bottom of Hudson's Bay.

The principal town of Lower Canada is Quebec, situated on a lofty promontary on the north side of the St. Lawrence: it is divided into two towns, the upper seated on the flat summit of a rock, at a great height above the river, and is well fortified: the lower town is confined between the bottom of this rock and the river, and is chiefly inhabited by persons employed in trade and the navigation of the river. The inhabitants of both are reckoned at 10,000, of whom two thirds are the descendants of the original French settlers.

Montreal stands on the southern side of a considerable island formed by the rivers St. Lawrence and Utawas, about 150 miles above Quebec: and so far can vessels of 400 tons ascend in favourable states of the river. Montreal contains about 6,000 inhabitants, who carry on a considerable trade in furs, that place being the principal station of what is called the North West Company.

The chief town of Upper Canada is York, situated in N. Lat. 43°. 35′. on the north side of lake Ontario, having an excellent harbour formed by a long neck of land. It is the seat of the government, and stands in a district promising to become in a few years a very valuable country. At the lower extremity of the same lake, where the river St. Lawrence begins, stands the town of Kingston, with a fort, carrying on a considerable share of the fur-trade.

The country of the Canadas is in general mountainous and woody, with many open plains and swamps, particularly in the upper province. Amongst the trees the maple is found, from which a sort of sugar is made for home consumption.

The most remarkable animals are the beaver; of whose

sagacity

sagacity in the construction of his hut, and the general tenor of his life, so much has been said: it is now, however, asserted, that he never tastes fish or any other animal food, living entirely on the roots, leaves, and bark of certain shrubs and trees which have no resinous juice. The moose-deer, or wapiti, is a variety of the European elk: it is a beautiful and stately animal, alied to, but much larger than, the common stag. In the northern parts the rein-deer and the lynx are not uncommon, and rattlesnakes are extremely numerous. The delicate humming-bird has occasionally been found in Canada, as also at the opposite point of South-America.

Little has hitherto been done to ascertain the mineral treasures of this widely extended district; lead and copper are, however, said to be met with in different parts.

New Brunswick.—Along the S. E. bank of the river St. Lawrence lies the extensive province of New Brunswick, erected, in 1784, into a separate government, independent of that of Nova-Scotia. In it is the considerable river of St. John, navigable for small vessels sixty miles up from the sea, and abounding in salmon, sturgeon, and other fish.

Frederick-town, the capital, lies on St. Johns's river, about ninety miles up from the sea. The principal productions of this country are cattle, timber, and fish.

Nova-Scotia.—This country is entirely enclosed by the sea, excepting at the isthmus on the north-west, where it is joined to New-Brunswick. Its length is about 300 miles, and the breadth about 80. The capital, Halifax, is seated on the western shore of a noble bay or harbour, being the most populous town in British America. On the west side of the province is Annapolis, a small town, with an excellent harbour.

The climate of this country during the long winter is very severe, and even the summer is foggy and damp, but it

is not unhealthy. The face of the province is hilly, and better calculated for pasturage than agriculture: the forests and fisheries are the chief advantages it affords.

The bay of Fundy, separating Nova-Scotia from New Brunswick, is noted for the prodigious swell of the tide, which runs to various heights, between forty-five and sixty feet.

Prince Edward Island.—Parallel to the northern coast of Nova-Scotia, and at the distance of ten or twelve miles, lies Prince Edward island, formerly called St. John's. The face of the country consists of gentle swellings, much intersected by many streams, forming a number of convenient harbours. The soil is fertile, and the climate is much more agreeable and healthy than that of any of the neighbouring countries. Charlotte-town is the principal place in the island.

Cape Breton.—This island is separated from the N. E. corner of Nova-Scotia by a channel only a mile in breadth. The chief place is Louisburg, with a harbour on the east side of the island. The climate is cold and foggy, the soil poor and unfit for agriculture. Besides a very valuable fishery on its coasts, the island affords some furs; and an extensive mine of coal has been worked for many years past.

Newfoundland.—This great island situated between 46°. 40′. and 51°. 30′. of N. lat. is of a triangular form, each side being above 300 miles in extent. The interior has never been examined, but along the shores it consists of a quick succession of rocky hills and lakes: many of the hills produce birch, and small pines and firs. The principal settlement is at St. John, with a harbour on the S. E. corner of the island: other places are Placentia on the S. and Bonavista on the E. sides.

From its situation, in the midst of a region covered with continual fogs, Newfoundland is quite unfit for the production of corn: but on its shores, and particularly on the

great banks, extending south and east from the island, is carried on the extensive cod-fishery, which has for many years proved truly a gold-mine to those concerned in it. The depth of water on the great banks is from 22 to 50 fathoms, while that off the banks is from 60 to 80. A great swell of the sea and thick fogs generally point out the situation of the great banks, which stretch from N. E. to S. W. about 200 leagues. The great fishery begins towards the middle of May, and continues to the end of September.

Anticosti.—A considerable island, dividing the broad mouth of the river St. Lawrence; possesses no convenient harbour, and is uninhabited; but it abounds with wood, and coal has been discovered in it.

Hudson's Bay.—Adjoining to Canada on the E. is a vast triangular peninsula, generally called Labrador, or the country of the Esquimaux, or Iskimos, from the name of the few wretched natives by whom its deserts are inhabited. This peninsula forms the separation between the Ocean and the great inlet called Hudson's Bay, on whose southern and western shores are some settlements for the purpose of carrying on the fur and other articles of trade with the natives of the northern and western parts of America: of these settlements, Albany Fort, Brunswick, York, and Churchill, are the chief.

The climate of this tract is extremely rude, the ice on the rivers being often eight feet thiek, and even brandy freezing. Whales, salmon, and sturgeon, are frequent in the bay and rivers. The rein-deer and great northern bear wander in herds along the shores, and the latter, for a great part of winter and spring, rove out to sea on the ice, while the famales, with their cubs, are concealed in the woods or banks of rivers till March, when they move down to the shore in search of their mates.

The ehief produce of these barren or at least uncultivated tracts consists in the furs or skins of beavers, bears, foxes, otters,

otters, martins, buffaloes, lynxes, wolverines, racoons, wolves, elks, deer, and other natives of the cold regions of the north.

THE UNITED STATES OF AMERICA.—These states are separated from the British possessions on the N. by an imaginary line passing through the middle of the great Canadian lakes and along the river St. Laurence to the parallel of 45°, which it follows due E. to a chain of mountains running N.E. and soon quitting them, it stretches S.E. to the river St. Croix, which it follows down to the sea. On the W. the boundary was formerly the course of the Mississippi; but the late acquisition of the wide plains of Louisiana has carried the boundary far beyond that river. Another imaginary line on the S. about the parallel of 30° divides the United States from the Spanish provinces of Florida, while Louisiana extends along the gulf of Mexico: On the E. they are washed by the Atlantic Ocean.

The extent of these states from W. to E. along the northern frontier, is about 1,300 miles, nearly equal to that along the Atlantic; but the distance from N. to S. between the lakes and Florida, is only about 1,000 miles. The limits of Louisiana and the more northerly acquisitions beyond the Mississippi are in a great degree indeterminate.

According to a numeration made in 1801, the population of the several United States, including the slaves, who are chiefly to be found in the southern states, was as appears in the following Table.

District of Maine	151,719
Vermont	154,465
New Hampshire	183,858
Massachussets	422,845
Rhode Island	69,122
Connecticut	251,002
New York	586,203
New Jersey	211,149

Pennsylvania

Pennsylvania	602,365
Delaware	64,273
Maryland	349,692
Virginia	886,149
Kentucky	220,960
North Carolina . . .	478,103
South Carolina . . .	345,491
Georgia	162,684
Tennassee	105,602
Ohio	45,365
Total . .	5,291,047

Some idea of the rapid increase of the population of the United States may be formed by comparing this total with that of 1791, which amounted only to 3,925,253, the augmentation in ten years exceeding one-third of the number in 1791. In 1801, the number of slaves in the whole Union was calculated to be 894,452.

The principal city or capital of the whole United States is Washington. This city, so named to preserve the memory of the illustrious founder of the Union, is situated in the midst of the country, in N. lat. 38°. 53′. within the territory of Columbia, at the junction of the river Patomak with the eastern branch, and intended to extend about four miles along each, including a tract of country exceeded in convenience, beauty, and salubrity, by none in America. The rivers afford excellent havens for any number of the largest ships. The town is to be laid out agreeably to a determined plan; the streets of a great breadth, straight, and crossing each other at right angles. The *Capitol*, or edifice, where the national councils are to be held, is projected on a very magnificent scale, on an elevated position in the heart of the town.

Philadelphia, the capital of Pennsylvania, is a handsome town

town, with 50,000 people, on the W. banks of the river Delaware, which brings large vessels up to the wharfs. New York, situated on a point of land at the mouth of the noble river Hudson, contains about 35,000 inhabitants, and from the advantages of its harbour and position is considered to be the first commercial town in the states. Boston, the capital of the different districts all known by the name of New England, contains about 20,000 people: the harbour on a spacious bay is capacious and secure, with a narrow entrance defended by forts; the town occupies a peninsula connected with the main land by an isthmus only 40 or 50 yards in breadth. Baltimore, in Maryland, contains 14,000 people. Charlestown, the capital of South Carolina, at the meeting of two considerable navigable rivers, is an agreeable trading town, containing about 16,000 inhabitants, of whom nearly one-half some years ago were slaves. The other towns of the Union are of less importance; but New Orleans, the capital of the newly acquired territory of Louisiana, may, from its position towards the mouth of the principal channel of the Mississippi, become a place of the greatest commercial importance in North America.

Christianity in many various modifications is universally professed in the American states; for the Jews are not numerous: but as the constitution of the country provides against the making of laws tending towards an establishment of any religious system, or prohibiting the free exercise of it, perfect religious liberty is a fundamental principle by which the American government is distinguished from that of any other country on the globe. Religion in the United States is placed on a proper basis, without the aid of the civil power, to be supported by its own evidence, by the lives of its professors, and by the care of its divine author.

The

The government consists of a president and vice-president, chosen for the term of four years; a senate or superior council, composed of two senators from each state in the Union, chosen every six years; and a house of representatives, elected every second year. The legislative power is vested in the two councils, and the executive in the president. The laws, both in their spirit and their application, have been retained from the system established before the separation of these states from Britain, with many excellent modifications adapted to the circumstances of the country and its inhabitants. It is highly worthy of notice, and of serious consideration, that since 1794, when in the state of Pennsylvania capital punishment was abolished for all offences, excepting wilful premeditated murder, the offences of every discription have not exceeded one half of the number committed before that period.

SPANISH DOMINIONS.—That part of North America belonging to Spain, since Louisiana has been ceded to the United States, may be considered as occupying the long irregular isthmus connecting the northern and southern portions of the New World. It is washed on one side by the gulf of Mexico, and on the other by the great Pacific Ocean. These dominions are divided into the following provinces, or kingdoms, as they are sometimes called, viz. California, New Mexico, New Leon, New Biscay, Mexico, Guatimala.

The climate of this extensive country, lying between N. lat. 5°. and 40°. is of course very various; rain is so frequent as greatly to moderate the natural heat. The face of the country is at once variegated and singular. Ranges of lofty mountains, many of them volcanoes and covered with snow, separated by rich vales and beautiful streams, every where present themselves. The soil is singularly fertile, furnishing in abundance corn, cattle, cotton, sugar, indigo, tobacco, and wine. The incomparable red dye, called

cochineal,

cochineal is also the produce of these dominions: it is the female of a very small insect found on a plant, called by the natives *nopal*, in the West Indies the prickly pear, and by botanists *cactus coccinillifera*, whose juices and flowers are of a beautiful red colour. The insects are placed on the plants in October, when the periodical rains are over, on the parts exposed to the sun. Each female affords about a thousand eggs, from which the young insects soon spread over the plant, as no less than six generations are usually produced every year. The insects are scraped from the plants into vessels, where they art dipped in water to kill them, and then dried in the sun: others kill them in an oven; but this method injures the beauty of the colour.

The mineral treasures of the Spanish part of North America are great beyond conception; the fifth part, which belongs to the crown, amounting to about two millions sterling annually. Silver is the principal product, but gold is also found in abundance. The chief mining station at this time is at Guanajuato, about 100 miles to the northward of the city of Mexico. Tin, lead, and copper, are also discovered in these rich tracts.

No country of equal extent presents so great a number of volcanoes, not fewer than fifty being at present in existence, besides those now extinct. The most remarkable is that of Orizava, about 60 miles south-east from Mexico, where its snowy summit is visible.

The chief city of Spanish North America is Mexico, singularly situated in a beautiful vale inclosed by mountains, in the neighbourhood of a cluster of lakes, extending ninety miles in circuit. The present town is built in a fenny situation, having been abandoned by the lake which surrounded it, when this country was first discovered. The town contains upwards of one hundred churches and chapels, and the population is reckoned to amount to 150,000. Vera Cruz, on the bottom of the gulf of Mexico, is the

port

port of the capital with respect to Europe, situated on a sandy barren plain. The harbour, or rather road, is very much exposed to the northern winds: but on a small island, half a mile from the land, is a considerable fort for its protection. Acapulco, 200 miles to the southward of Mexico, on a spacious and well protected haven, is the station of the commerce between the Spanish dominions in North America and those in the Asiatic islands.

Towards the narrowest part of the isthmus, between the northern and southern parts of this continent, is situated the great lake of Nicaragua, about 170 miles in length, and nearly half as much in breadth: from the east end flows the river St. John, falling into the gulf of Mexico, and navigable for the largest ships up to the lake. The west end of the lake approaches within a dozen miles of the southern ocean, which has suggested the project of opening a spacious canal fit for vessels of burthen, and so procuring a safe and speedy communication between the Atlantic and the Pacific, instead of encountering the dangers and delays of a voyage round the southern extremity of America, or attempting a probably impracticable passage round the northern.

To the northward of the lake of Nicaragua lies the coast of Honduras, well known for its abundance in mahogany and logwood.

West India Islands.—The mouth of the great gulf of Mexico, inclosed between N. and S. America, is shut in by a long chain of islands of various sizes; beginning at the N. W. extremity, and proceeding to the S. E; their names are the following, viz. the Lucaya or Bahama islands, Cuba, Jamaica, Hispaniola, Porto Rico, the Virgin isles, the Caribees, comprehending St. Croix, St. Martin, St. Eustatia, St. Christopher or by abbreviation St. Kitts, Antigua, Monserrat, Guadaloupe and Grande-terre, Marie-galante, Dominica, Martinique, St. Lucia,

Barbadoes,

SOUTH AMERICA.
ATLANTIC OCEAN
PACIFIC OCEAN OR SOUTH SEA
SOUTHERN OCEAN
CARIBBEAN SEA
AMAZONIA
BRASIL
TERRA FIRMA
NEW GRANADA
Equinoctial Line
Tropic of Capricorn
Meridian of London.
West Longitude from London
East Longitude
Gallipagos Is.
Easter I.
Juan Fernandes I.
Chiloe I.
Falkland Isles
Georgia
Sandwich Land
Straits of Magellan
Terra del Fuego
C. Horn
Staten Land
Lima
Quito
Potosi
Buenos Ayres
Riv. of Plate
Rio Janeiro
St. Salvador
Olinde or Pernambuco
Cape St. Roque
R. Amazon
Paramaribo
Cayenne
Baldivia
Truxillo
Arica
Assumcion
St. Fe
Panama

Barbadoes, St. Vincent, Grenada, Tobago, Trinidad. Of these the most considerable are Cuba and Porto Rico, belonging to Spain; Hispaniola, otherwise called St. Domingo, from the principal town on the south coast, once divided between Spain and France, but since the revolution in France entirely in the hands of the revolted slaves; and Jamaica, the principal British settlement in that quarter of the world. The natural productions, climate, and soil of these islands are in a great measure the same; they are in general mountainous, and in many parts extremely fertile in sugar, rum, tobacco, coffee, cotton, and indigo. Jamaica is in length about 170 miles, and 60 in its greatest breadth. It is divided into three counties; Cornwall in the west, Middlesex in the centre, and Surry in the east; the whole subdivided into twenty parishes. The number of inhabitants exceeds 20,000, that of free negroes and mulattoes (in the West Indies called people of colour) 10,000, while the slaves are computed to be about 250,000. The seat of government is St. Jago or Spanish-town, situated back from the shore; but the principal place is Kingston, a place of great trade and opulence, on the north side of a beautiful bay, forming a secure and spacious haven. In 1788, the population of Kingston consisted of 6,539 whites, 3,280 free people of colour, and 16,659 slaves, in all 26,478 inhabitants. Port-royal, once a place of the greatest importance, is now greatly reduced by repeated earthquakes and inundations of the sea; it still, however, contains the royal dock-yard, navy hospital, and barracks for troops; it is well fortified, and occupies the extremity of a long sandy neck, forming the south side of Kingston harbour.

South America:—This great portion of the new world is separated from the northern by an ideal line, from the gulf of Mexico, in N. lat. 9° to the Pacific ocean, in lat. 7° 40'. considerably to the westward of the narrowest

part of the isthmus of Panama. The extent from N. to S. is about 4,080 geographic miles, and the greatest breadth from W. to E. about 2,700.

South America presents long ranges of mountains, the most elevated of any on the globe, at least, so far as their elevation has hitherto been accurately determined. The great *Cordillera*, or chain of the Andes, extends from N. to S. the whole length of the country, their western slopes washed by the Pacific ocean; but from them to the Atlantic, on the east, the country presents in general one vast plain. A singularity of this chain of mountains is, that the lofty peaks do not spring from the ordinary level of the country, but from a broad range of plain table land, itself elevated eight or ten thousand feet above the sea. Chimborazo, the highest peak, situated in S. lat. 1° 30', rises to the height of above 20,000 feet, or nearly four English miles, and, although lying almost under the Equator, is covered with perpetual snow 2,500 feet perpendicularly below the summit. From the N. end of the Andes, a branch, rising in some places to the height of 14,000 feet, lines the northern shores of S. America, disappearing opposite to the island of Trinidad: many of the S. American mountains are volcanic.

In proportion to the elevation and extent of the mountains of S. America, the rivers of that portion of the earth surpass those of other parts for quantity of water and length of course. The great river of the Amazons, or the Maranyon, has its origin in a lake, on the east side of the Andes, in S. lat. 11°, whence, after a circular sweep, it turns to the N W. to N. lat. 5°, where it begins its long eastern course, and opens into the Atlantic, under the Equator, by a mouth divided by low islands into many channels, and so broad, that a considerable way up from the sea the one bank cannot be seen from the other. The tide is perceptible 600 miles from the mouth; and the course of this

river,

river, the largest in the world, is not less than 3,300 miles. The second river of S. America is that which, formed by the union of the Paraguay and other streams, in the centre of the country, flows in general south easterly, and is lost in the Atlantic, by the broad firth of La Plata, so called from the Spanish term signifying silver, of which great quantities are brought down these rivers to be embarked for Europe. The third American river is the Orinoco, which, after a winding spiral course, discharges itself into the Atlantic by many mouths, opposite to the island of Trinidad. So level is that part of America where the Orinoco and the Maranyon bend their course, that no less than three communications by different branches have been traced leading from one river to the other; these rivers, and many others in S. America, also periodically overflow the adjacent country, as do the Nile, the Ganges, &c. but to a far greater extent on both sides of the stream.

The lakes of this part of the world are neither numerous nor considerable; that of Parima, in the northern parts, is about 100 miles long, by 50 broad. The lake, or lagoon, of Maracaibo, although communicating by a broad channel with the Caribean sea, is a body of fresh water, above 100 miles in its greatest extent. On the eastern shore is a spot producing mineral pitch, or *bitumen asphaltum,* useful for tarring ships' bottoms, and for other purposes; and the inflamed vapours arising from it serve as a light-house to vessels navigating the lake. Titicaca is the most extensive lake in S. America; it is situated on the eastern skirts of the Andes, and is 240 miles in circumference, being generally from 70 to 80 fathoms in depth; the water is not salt, but tainted with sulphur and bitumen.

Spanish Dominions.—These are comprehended in the three great governments, or viceroyalties, of New Grenada, Peru, and La Plata. New Grenada occupies the N W. parts from S. lat. 3° 30′ to N. lat. 12°, extending nearly

1,000

1,000 miles from N. to S. and in general about 240 from W. to E. and is subdivided into twenty-four provinces. The chief towns are Santa Fe de Bogota, in the heart of the country, the seat of government, and a handsome place, containing 30,000 people. Quito, situated nearly under the equinoctial line, is supposed to contain 58,000 inhabitants of all descriptions: it was in the vicinity of this town that the measurement of a degree on the earth's surface was performed by Spanish and French mathematicians, about seventy years ago. Guayaquil is a port of considerable trade in the southern parts of the government, where an arsenal has been constructed for the use of the navy. Panama, on the south side of the isthmus of Darien, with Portobello on the north side, and Carthagena on the southern continent, were once more remarkable for commerce than at the present day.

Caracas.—Along the northern shores of S. America, from New Grenada to the Atlantic, extends the government of the Caracas, divided into five provinces, viz. Venezuela, Maracaibo, Cumana, Spanish Guiana, the island of Margarita: Caraca, the principal town, is situated a dozen miles from the sea, in the midst of mountains, a considerable place, containing upwards of 40,000 people. By the town runs the small river La Guayra, forming at its entrance into the sea the harbour or road of the same name. Porto Cavello is a convenient harbour to the westward of La Guayra.

Peru.—This part of the Spanish dominions extends along the shore of the Pacific, from S. lat. 3° 30′ to 21° 15′, in a south easterly direction, about 1,400 miles; but the breadth is very irregular, the medium being about 200 miles. It comprehends forty-two provinces; the capital, Lima, with a population of above 50,000 inhabitants, lies a couple of leagues up from the sea, the port, since the overthrow of Callao by an earthquake, in 1747, being

Bellavista,

Bellavista, in the neighbourhood. Cuzco, formerly the residence of the native sovereigns of the country, stands in the midst of the lofty Andes.

Chili.—This is a long narrow tract, reaching southwards from Peru to S. lat. 40°, hemmed in between the Pacific and the Andes. The Spaniards claim only so much of this country as reaches to the river Biobio, in lat. 37°, the remainder being in the hands of the natives, a race differing in many points from the other original inhabitants of S. America. The chief towns of the Spanish part are St. Jago, in the interior, and Conception, on the coast.

La Plata.—This very extensive country, called also the Viceroyalty of Buenos Ayres, from the name of the capital, occupies all the heart of S. America from the chain of the Andes to the Portuguese dominions and the Atlantic ocean. It reaches from S. lat 14° to 38°, or about 1500 miles, and the breadth is about 720 miles, being divided into thirty provinces. The capital, Buenos Ayres, so called from the excellence of the air it enjoys, is situated on the southern shore of the great river La Plata, there upwards of 20 miles across. The town is large and regularly built, with a population of 40,000 souls. The harbour is only an open road, so that vessels usually remain at Montevideo, lower down on the opposite side of the river, commanding a fine bay. The most celebrated town, however of this portion of America is Potosi, lying in a barren mountainous tract, in S. lat. 19°. 40′, amongst the eastern slopes of the Andes: but by means of rivers in the neighbourhood a water communication is established with Buenos Ayres. Potosi was founded in 1545, and the mountain where it stands has ever since furnished to Europe a quantity equal to one million sterling annually of fine silver.

Amongst the natural productions of Spanish S. America may be reckoned the quinquina, or Jesuit's bark, also sarsaparilla,

saparilla, rhubarb, jalap, sassafras, guayacum: the chocolate tree grows chiefly in Peru, the fruit resembles a cucumber, containing the nuts, covered with a very sweet skin: vanilla, which enters into the composition of chocolate in Europe, is found in the same country. The minerals, next to those of New Spain, are the most valuable in the world, particularly in silver; while some parts are distinguished for vast quantities of the purest gold: mines of copper, tin, and lead, are also worked. The celebrated Vicunya, or Vigogna wool, is procured from a species of small camel of which there are other sorts, called llama, or liama, guanaco, paco, &c.; the paco, which is the largest, is frequently employed as a beast of burthern in Peru, carrying a load of one hundred and a half. The tiger, or jaguar, of Paraguay, is amongst the largest of the species: but the puma, or lion, is proportionally inferior in size to that of the old continent. The hippopotamus is found in the great rivers; and the condor, a species of vulture, is no stranger in the mountains; some have been measured sixteen feet across the wings when extended.

PORTUGUESE DOMINIONS. These form one great triangle, having its vertex on the sea coast, in S. lat. 33°. the eastern side is washed by the Atlantic ocean, the western is bounded by the Spanish dominions, and the northern side, or the base, is formed by the river of Amazons, French Guiana, and the Atlantic. The extent from S. to N. is about 2,100 miles, and the breadth, at the base, is nearly as much. This widely extended country, generally known by the name of Brasil, is subdivided into upwards of twenty provinces; but the whole is in a great measure unknown to Europeans, the Portuguese having done little more than form some establishments on the coast.

The principal town of all these provinces was formerly San Salvador, on the *Bahia de todos os Santos* (bay of All Saints

in S. America: the inhabitants have been estimated at about 100,000, of whom nearly one-third may be Europeans or their descendents. Considerably farther to the southward, on the river called in Portuguese *Rio Janeiro* or January river, stands Sans Sebastian, or, as it is usually but improperly called Rio Janeiro, on a capacious and secure harbour, now become the place of the greatest trade in Brasil; the surrounding country, besides a great abundance of the productions commonly found in similar climates, furnishing gold in great quantities, besides diamonds of an inferior sort to those of India, being often of a brownish obscure hue.

Brasil is in general a tract of uncommon fertility; but the interior is mostly incumbered with forests: it affords, however, even in its present neglected state, prodigious quantities of sugar, cotton, coffee, chocolate, ginger, pepper, capsicum, jalap, with many other aromatic and medicinal plants: the Brasil wood, and various other dye-stuffs, are likewise produced in abundance.

Dutch Possessions.—These occupy a tract of about 300 miles along the coast of the Atlantic, between the mouths of the Orinoco and the river of Amazons: the extent back from the coast is very irregular, but along the rivers it amounts to about 150 miles. The country towards the coast is one unvaried plain, intersected by many considerable rivers, which render the soil extremely fertile; but the heats and moisture of the climate render it peculiarly unfavorable for Europeans. The chief towns are Paramaribo on the river Surinam, from which the colony itself is often called Surinam, although the Essequibo be a greater stream: Demerara is another settlement on a river of the same name. The principal productions, are sugar, coffee, cocoa, and cotton. These possessions have for some years been in the hands of the British.

French Possessions.—Adjoining to the eastern boun-

dary of the Dutch settlements lies that part of Guiana belonging to France: its length along the shore is about 360 miles, but the interior is still entirely in its natural state and unoccupied. The chief and indeed the only town is Cayenne, situated on the extremity of an island 15 miles in length, at the mouth of two rivers there falling into the sea; and from this town the colony itself is usually called Cayenne; the harbour, although but indifferent, is the best on that tract of coast. This colony furnishes abundantly that species of capsicum, which is known in Europe by the name of Cayenne pepper; other vegetable productions are the quassia, a very powerful bitter, the ricinus which affords the castor oil,balsam of capivi,ipecacuanha, &c. the substance called Indian rubber elastic gum or caoutchoue is the thickened milky juice of a tree the growth of the same colony.

Patagonia.—The southern extremity of S. America is hitherto an unconquered and an unknown country, amongst the inhabitants one race has occasioned much curiosity, as if they were a nation of gigantic stature. Of this race the most authentic description is to be found in the account published by the Spanish government of a voyage performed in the end of 1785, and begining of 1786, for the purpose of once for all determining the propriety of vessels bound for the Pacific ocean attempting to pass through the strait of Magellan, which separates the continent of S. America from the cluster of isles called in general Tierra del Fuego.

The officers employed on that expedition have, in the following passage of their narrative, put an end to all further discussion on this subject. "The Patagonians," say they, "so first named by Magellan, are certain tribes of wandering uncivilized people, occupying the vast tract of country stretching from the river La Plata to the strait; their ordinary abode is in the interior of the country; but in the hunting season they approach the strait where we had various oppor-

opportunities of observing and carrying on intercourses with them. Their stature, without controversy, exceeds that of the generality of Europeans; we measured carefully some of the tallest, and found their height to be 7 feet $1\frac{1}{4}$ inch Spanish measure",[equal to 6 feet 6 inches English,] " and the ordinary height was from 6 feet 6 inches to 7 feet Spanish", [or from 5 feet $11\frac{2}{5}$ inches, to 6 feet $4\frac{9}{10}$ inches English,] " the stature of this race of people is therefore not so remarkable as the size of their bodies, many of which are not less than 4 feet 4 inches", [nearly 4 feet English] " round the breast; their arms and legs are not, however, in proportion to their size; but their head is comparatively large and broad for even their uncommon bulk."

Islands of S. America.—The most remarkable islands on the coast of S. America are the groupe called *Tierra del Fuego*, the land of fire, not from any volcanoes observed, but from the frequent fires lighted up on both sides of the strait, as the Spaniards in November 1520, under the enterprising Magellan, passed through from the Atlantic to the Pacific on the first circumnavigation of the globe. These islands are in general covered with perpetual snow, and are inhabited by a few wretched wanderers in the very lowest stage of civilization; and in many particulars closely resembling the corresponding savages of New Holland.

On the western coast of S. America lies *Chiloe*, an island extending about 120 miles in length, by 25 in breadth. In a more genial climate, and at the distance of 400 miles from the nearest land, lie a couple of islands called in common those of *Juan Fernandez*, discovered by the Spaniards in 1675. The largest, about 15 miles in length and 6 in breadth, is a beautiful and fertile island, but chiefly remarkable as the solitary abode of Alexander Selkirk a Scotchman, who on a voyage round the world

was at his own request left there, and after a space of five years was in 1710, relieved by an English vessel and brought to England. From the history of this recluse, Danial Defoe is said to have formed his celebrated and popular work, entitled the adventures of *Robinson Crusoe.*

ASTRONOMY

Fig 1.

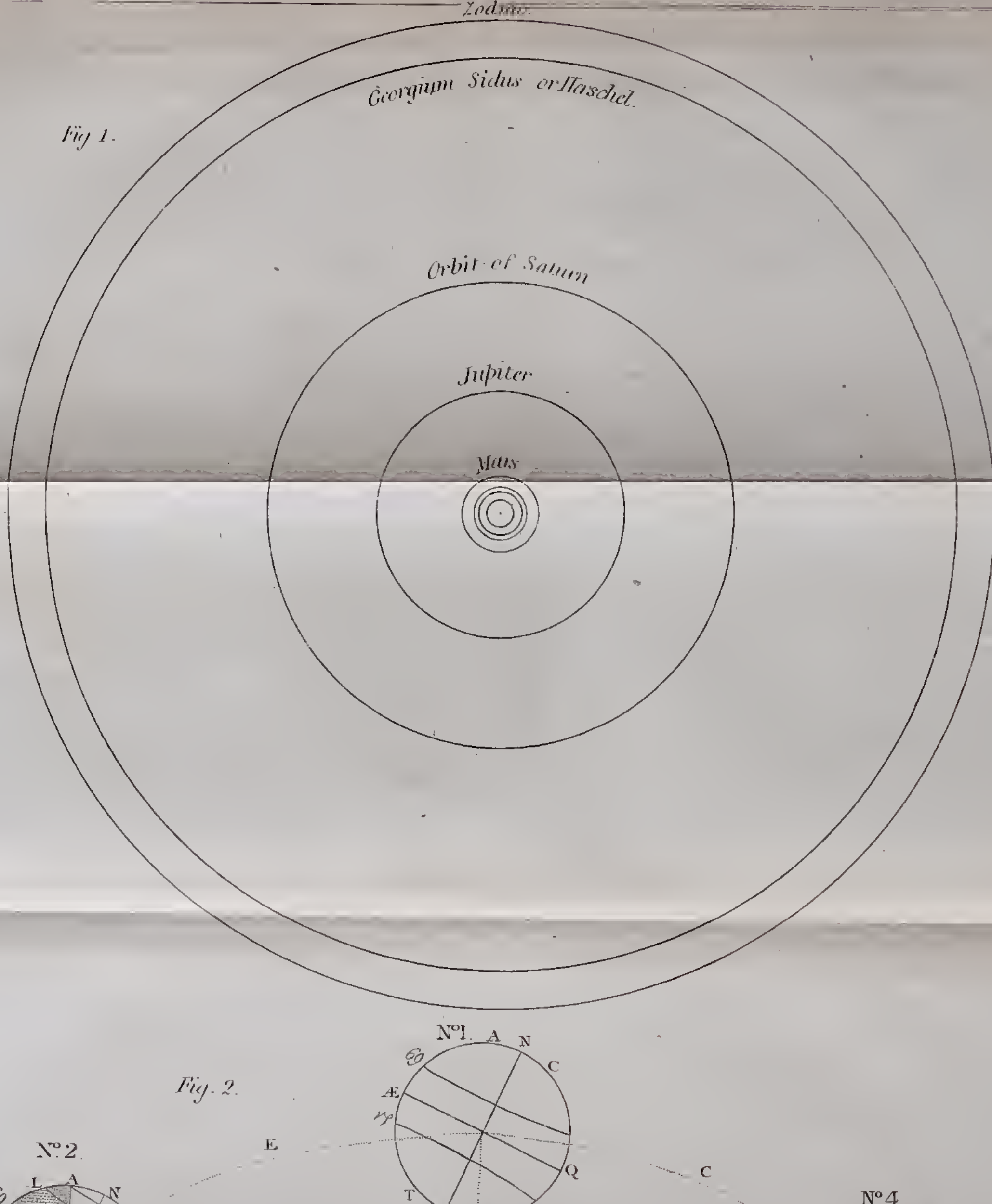
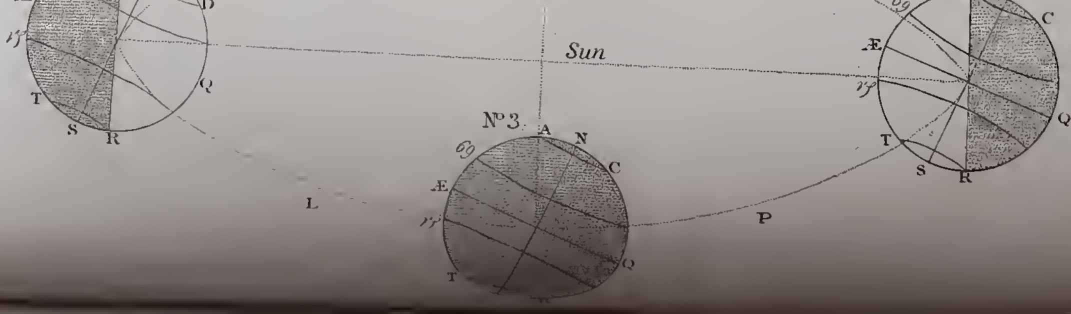


Fig. 2.



THE

MODERN PRECEPTOR.

CHAPTER VII.

ASTRONOMY.

The object of Astronomy is to explain the nature and motions of the heavenly bodies, and the laws by which these motions are governed, agreeably to the import of the two Greek words composing the name, viz. *astron,* a star, and *nomos,* a law. Astronomy has engaged the attention of mankind of all ages, and in every stage of rudeness or refinement; various theories having at different periods been formed and promulgated by the learned; that, however, which is now universally adopted by men of science is the theory of *Nicolaus Copernicus,* born at Thorn, in Prussia, in 1472, who, in 1543, a little before his death, produced the system known by his name, to the formation of which he had been led partly by considering the absurdities of the prevailing theories of his day, and partly by a few hints scattered in antient authors of the opinions of Pythagoras and other eminent men of the earliest times.

Of the Copernican system, the following are the principal articles. The sun, the great source of light and heat to the earth we inhabit, is fixed in the centre of a system of other bodies, revolving round him at different distances and in different

different periods of time, of which this earth is one. These bodies, arranged in the order of their proximity to the sun, are Mercury, Venus, the Earth, Mars, Jupiter, Saturn, all visible to the naked eye, together with three others, only discoverable by means of glasses, viz. Ceres, Pallas, Herschel, otherwise called the Georgian planet, or Uranus; Ceres and Pallas describing their course between Mars and Jupiter, while Herschel is removed to a great distance beyond Saturn, and probably towards the utmost verge of the Solar system. Of the magnitudes of these bodies, and of their several distances from the sun, the periods of their revolutions round his body and round their own axes, and some other particulars, a competent notion may be obtained from the following table.

Names.	Mean diameters in English miles	Mean distances from the Sun in English miles.	Inclinations of orbits to the Ecliptic, 1780.	Inclination of axis to orbits.	Diurnal rotation on their axis.	Tropical revolutions.	Sidereal revolutions
			° ′ ″	° ′ ″	d. h. m. s.	d. h. m. s.	d. h. m. s.
Sun	883,246	—	—	82 44 0	25 14 8 0	—	—
Mercury	3,224	37,000,000	7 0 0	—	—	87 23 14 33	87 23 15 44
Venus	7,687	68,000,000	3 23 35	—	0 23 21 0	224 16 41 28	224 16 49 11
The Earth	7,911.7	95,000,000	0 0 0	66 32 0	1 0 0 0	365 5 48 49	365 6 9 12
Mars	4,189	144,000,000	1 51 0	59 22 0	1 0 39 22	686 22 18 27	686 23 30 36
Ceres	160	260,000,000	10 37 57	—	—	1681 12 9 0	—
Pallas	80	266,000,000	34 50 40	—	—	—	1703 16 48 0
Jupiter	89,170	490,000,000	1 18 56	90 nearly.	0 9 55 37	4330 14 39 2	4332 14 27 11
Saturn	79,042	900,000,000	2 29 50	60 probably	0 10 16 2	10,746 19 16 16	10,759 1 51 11
Herschel	35,112	1800,000,000	0 46 20	—	—	30,637 4 0 0	30,737 18 0 0

In this table the first column contains the names of the sun and the planets composing his system; the second shews the diameter of each body in English miles, on the supposition of its being a perfect sphere; the third, the distance of each planet from the sun, on the supposition of its moving round him in a circle; the fourth, the angle of inclination formed by the plane of the orbit of each planet with that of the orbit of the earth or the ecliptic; the fifth, the angle formed by the direction of the axis of each planet with the plane of its own orbit; sixth, the time in which a planet performs one revolution round its axis, or the length of the day; seventh, the time in which a planet performs its revolution round the sun from any given point of its orbit to its return to the same point, or the length of its tropical year; and the eighth indicates the time required by a planet in passing from a conjunction with any fixed star, as observed from the sun, to its return to the same star, after a complete revolution round the sun, or the length of its sidereal year.

Thus, for example, the second column points out, that if the sun were a perfect sphere, its diameter would be 883,246 English miles; the fifth column, that the axis on which he turns is inclined in an angle of 82 deg. 44 min. to the plane of the ecliptic, or the orbit of the earth; the sixth column, that his revolution round his axis is performed in a period of 25 of our days, 14 hours, and 8 minutes: the other columns corresponding to the sun are void; because the matters contained in them are inapplicable to that luminary, who remains unchangeably fixed in the centre of the revolutions of the other bodies named in the table.

Again, the table shews that the diameter of the earth, were it a perfect sphere, would, according to the calculation upon which the table is founded, be nearly 7,912 English miles. (See *Geography*, vol. ii. p. 7.) that, were the orbit or path described by the earth, in its annual revolution

round

round the sun, a circle, its radius, or in other words, the mean distance from his body would, in round numbers, be about 95 millions of miles; that the position of the earth's axis formed, in 1801, an angle of about 66 deg. 22 min. with the plane of the ecliptic or of the orbit traced by the earth in its annual motion round the sun; that the period in which the earth performs one entire revolution round its axis is what we call a day; that the period elapsing between the earth's departure from any given point of her orbit, and her return to the same point, after travelling round the sun, as observed from his body, or what we call a year, or properly the tropical year, contains 365 days 5 hours 48 minutes and 49 seconds; but that the period elapsing between the earth's departure from any fixed star, as seen by an observer in the sun, and her arrival at the same star again, amounts to 365 days 6 hours 9 minutes and 12 seconds.—But to be more particular—

Mercury is a globe of 3.224 English miles in diameter, and the nearest to the sun of the known planets of our system, his mean distance being about 37 millions of miles. He emits a very bright white light; but it is seldom he can be observed, from his being always so near the sun as to be involved in his rays, excepting a short time before the rising or after the setting of that luminary. The angle formed at the eye of an observer on the earth, by lines drawn from Mercury and the Sun, never exceeds 27° 5′, so that this planet never sets after, nor rises before, the sun, more than 1 hour and 50 minutes. Mercury's year contains, by the preceding table, very nearly 88 days; but the length of his day, or of his revolution round his axis, has not yet been ascertained.

Venus. This planet is of peculiar brilliancy; and hence, according to her appearance before sun-rise or after sun-set, is commonly called the *morning* or the *evening-star.* Being both at a greater distance from the Sun, and nearer to

us than is Mercury, the angle formed at our eye, by lines drawn from her and the Sun, is considerably greater than that formed by lines from Mercury and the Sun, amounting at times to 48 degrees. Venus turns round on her axis once in 23 hours 21 minutes, which is the length of her day; and her year, or the time required to perform her revolution round the sun, is nearly 224 of our days 17 hours.

The *Earth*. This planet, on which we dwell, is the next in order of distance from the Sun; Venus and Mercury revolving between him and us are therefore commonly, although inaccurately, called the *inferior* planets, whilst Mars, Jupiter, and the others, moving in orbits farther removed than the Earth from the Sun, are termed the *superior* planets. The Earth, as appears from the preceding table, moves in an orbit distant from the Sun in the centre at a medium of about 95 millions of English miles: her revolution on her axis is performed in 24 hours, or 1 day, and her revolution in her orbit in one year, or nearly 365$\frac{1}{4}$ days; she is attended by one satellite, which we call the moon.

Mars. This planet, the next on the outside of the earth, presents a dull red firy colour; his medium distance from the Sun is about 144 millions of miles: his daily revolution on his axis is performed in about 24 hours and 40 minutes of our time, and his year occupies nearly 687 of our days.

Ceres and *Pallas*. Of these planets, but lately discovered, very little is yet known; they are both much smaller than the other planets of our system, the diameter of Ceres being only 160 miles, and that of Pallas not exceeding 80.

Jupiter. This is the largest planet of the solar system, his diameter approaching to 90 thousand miles: in splendour he sometimes rivals Venus herself; his daily revolution on his axis is performed with such velocity, as to require only about 10 of our hours; but his year demands upwards of 4,330 of our days, or nearly 12 of our years. Jupiter, when examined through a telescope, presents a number of spots

spots and belts upon his surface; these belts are variable in position and number, from one to eight; they are in general parallel to one another, but not constantly so, nor is their breadth always the same, one gradually increasing while another beside it proportionally decreases. The changes in the appearance of these belts and ſpots, and the difference in the periods of their rotation round his axis, make it probable that they are not on the surface of Jupiter, but rather clouds transported by the winds with different velocities in his atmosphere, which must be subject to violent agitations.

Jupiter is accompanied by four small planets or satellites, revolving round him as a centre, analogous in all respects to the moon which accompanies the earth. They are placed at different distances from his body, and perform their revolutions in different periods, the places of their orbits varying a little the one from the other, and all from that of the orbit of Jupiter himself. By employing half the diameter (the semi-diameter) of Jupiter, as a standard by which to measure the distance of his satellites or moons from his centre, it has been observed, that the nearest to to him, or the first satellite, is distant 5.697 semi-diameters, subtending at the eye of an observer on the earth an angle of 1 minute 51 seconds; and that it performs its revolution round Jupiter in 1 day 18 hours 27 minutes 34 seconds of our time. The second satellite revolves at the distance of 9.017 semi-diameters, subtending an angle of 2 minutes 56 seconds, in 3 days 13 hours 13 minutes 43 seconds. The third satellite, at the distance of 1.4384 semi-diameters, or 4 minutes 42 seconds in seven days 3 hours 42 minutes 36 seconds. The fourth revolves at the distance of 25.266 semi-diameters, subtending an angle of 8 minutes 16 seconds in 16 days 16 hours 32 minutes 9 seconds. The semi-diameter of Jupiter being about 44,585 English miles, his first satellite revolves at a distance of only about 250,000 miles from his centre; his second, at

 the

the distance of about 402,000 miles; his third, at 640,000 miles; and his fourth, at the distance of 1,113,600 miles.

Saturn. This planet is very bright, but inferior in brilliancy, as well as in magnitude, to Jupiter; his diameter being about eight-ninths of that of the latter. His daily revolution on his axis is equal to 10 hours 16 minutes of our time; but his year or revolution round the sun extends to 10,756 days, or nearly $29\frac{1}{2}$ of our years.

Saturn is attended by no fewer than seven moons, or satellites. The first revolves at the distance of 4.893 semi-diameters of Saturn from his centre, in 1 day 21 hours 18 minutes 37 seconds of our time; the second at the distance of 6.268 semi-diameters, in 2 days 17 hours, 41 minutes 22 seconds; the third at the distance of 8,754 semi-diameters, in 4 days 12 hours 25 minutes 12 seconds; the fourth at 20.295 semi-diameters, in 15 days 22 hours 41 minutes 12 seconds; the fifth at 59,154 semi-diameters, in 79 days 7 hours 47 minutes. The two remaining satellites of Saturn were discovered in the years 1787, and 1788, and are placed nearer to the body of Saturn than any of the preceding five; but, in order to prevent confusion in speaking of them, they are numbered the sixth and seventh satellites: the 6th revolves round Saturn within the orbit of the first, at the distance of $3\frac{5}{6}$ semi-diameters, in 1 day 8 hours 53 minutes, 9 seconds; the seventh, which is the nearest to Saturn's body, at the distance of only $2\frac{5}{6}$ semi-diameters, in the short space of 22 hours 40 minutes 46 seconds. These moons, therefore, arranged in the order of their proximity to the body of the planet, are the seventh, the sixth, the first, the second, the third, the fourth, and the fifth.

Saturn, observed through a telescope, presents an appearance different from that of every other heavenly body hitherto discovered. It appears that his globe is surrounded in the plane of his equator by a broad thin ring, at a distance from his body equal to the breadth of the ring; so that if the

the diameter of his globe be divided into three equal parts, one of these parts would be equal to the breadth of the ring and one to the interval between his body and the ring, making the exterior diameter of the ring equal to seven of such third parts. As we never come to be in a position perpendicular to the plane of the ring, we never can observe it completely round, or even in all parts detached from the body of the planet; and when, by the motions of Saturn and the Earth, we come to be in the plane of the ring, it then ceases to be visible, in all probability from its being too thin to reflect light to us: in this state, however, the ring has been perceived, with good glasses, as a dark line crossing the planet's surface. The ring revolves round the same axis with the planet itself, but in a longer time, being of a much greater diameter; for Saturn performs his diurnal revolution in 10 hours 16 minutes, while the ring requires 10 hours 32 minutes 15.4 seconds. By more accurate observations, it appears that this ring is probably composed of two concentric rings; for a dark belt, or broad line, runs round the surface of the ring, dividing it into two rings, the inner much broader than the outer. The following are the proportional breadths of these rings, and their distances the one from the other, and from the centre of Saturn.

	Parts.
If the distance from his centre to the inner edge of the inner ring be divided into any number of equal parts, as	590
The radius of the outer edge of the same ring is	751
Consequently the breadth of the inner ring is .	161
The radius of the outer edge of the inner ring .	751
Ditto of inner edge of outer ring . .	774
Breadth of belt or space between the rings .	23

Radius

Radius of inner edge of outer ring . .	774
Ditto of outer edge of the same ring . .	830
Breadth of outer ring	56

Herschel. This planet, called also *Georgium Sidus*, or the Georgian Planet, and *Uranus*, which had escaped the notice of all ancient astronomers, and even by the moderns was considered only as a fixed star, was, in 1781, by the celebrated astronomer whose name it bears, proved to be a moveable body, in all respects similar to those already described. This planet, although of great size, its diameter exceeding thirty-five thousand miles, performs his course at a distance so great, that it is seldom he can be discovered by the unassisted eye. His distance from the sun is computed to be about eighteen hundred millions of miles, or nearly two hundred times the distance of this earth from the sun. The period in which Herchel performs his diurnal revolution on his axis, has not yet been properly determined; but his annual revolution extends to no less than 30,637 of our days, or nearly 84 of our years.

Herschel is accompanied by six moons, or satellites, to be seen only by the use of the most powerful telescopes: of their magnitudes, distances from that planet, and periodical revolutions, little has yet been ascertained; but in one particular these satellites vary from the practice of all the other heavenly bodies, in performing their revolutions from east to west.

The bodies described as performing these revolutions round the sun, are termed primary planets, and the others revolving round these are called secondary planets or satellites, as constantly attending the primary.

It has already been said, that the earth is accompanied by

by one satellite, which we call the moon, revolving at the distance of 60 $\frac{1}{2}$ semi-diameters of the earth, equal to 240,000 miles; her diameter is about 2,180 miles, somewhat more than the fourth part of that of the earth; the extent of her surface must, therefore, be nearly one-thirteenth part of the surface of the earth. Were the earth immoveable in its place in the heavens, the moon, by her ordinary motion, would perform a complete revolution from any given point of her orbit, to the same again, in about 27 days 7 hours 43 minutes 11 seconds: but, as during this period, the earth has been in progressive motion, in its annual orbit round the sun, it will require 29 days 12 hours 44 minutes 3 seconds, to bring the moon to a point corresponding to that from which her revolution was computed; and this last period is what we call a month.

The plane of the path described by the moon, or of her orbit, does not coincide with the plane of the earth's path, or of the ecliptic, being inclined to it in an angle of 5 degrees 8 minutes 48.9 seconds; and as she performs twelve revolutions round the earth in less time than the earth performs one round the sun, she must to us appear to follow a very irregular course through the heavens. The most remarkable circumstances, however, relating to the moon, are the continually varying appearances (or *phases*, according to the Greek term usually employed) she presents in the course of a revolution. As the moon, like our earth, and all the other planets, is an opaque, that is, a dark solid body, yielding no light of itself, but only illuminated by the rays of the sun, no part of her body can be seen, but when it is enlightened by those rays. Let us then suppose the moon, in the course of her revolutions round us, to be directly in the line between us and the sun; in this case it is evident no part of the illuminated body can be visible on the earth: next let the moon advance a little in her course, from east to west, the sun enlightening still one-half of her surface, a small

small portion of it will begin to be perceptible to the westward of the Sun as he sets, in the form of an arch, or crescent, as it is called, broadest in the middle, and terminating above and below in sharp points. The illuminated part bending outwards towards the sun, on the moon's western edge. When she has arrived so far on her journey that a line from the earth would at the moon form a right angle with another line from the sun, one half of the illuminated side will be visible to us, presenting the appearance of a semi-circle or half moon, and she is then said to have accomplished her first quarter. From this point, still proceeding from west to east, she will discover to us more and more of the illuminated hemisphere, bounded by two arches, and is then said to be gibbous or hump-backed. When she has performed one half of her revolution, and comes to be directly in opposition to the sun, on a line drawn from him through the earth to her, we are then in the centre of the sun's rays falling on her body, and discover the whole illuminated hemisphere: the moon is then said to be full, or in her second quarter. Continuing her progress, the moon passing to the eastward of the line joining the earth and the sun, we no longer can perceive the whole enlightened part of her surface, but she again assumes a gibbous appearance, as in the portion of her course from the half to the full moon, with this difference only, that the illuminated parts, equally turned towards the sun as before, occupy her eastern edge. In this manner she advances to a point, where lines from her to the sun and to the earth would form a right angle at her body, when one half only of the enlightened portion being visible to us, she again presents the appearance of a half moon, and has accomplished the third quarter of her revolution. From this stage, gradually approaching the line joining the sun and the earth, she assumes the appearance of a crescent, as in the beginning of her course, but in a reversed position; and at last coming

ing to be directly between us and the sun, the illuminated portion of her surface entirely disappears, and she ceases to be visible to us. This point of conjunction of the moon with the sun is what is called the new moon.

Did the moon revolve in the plane connecting the sun and the earth, as often as she came into conjunction with the sun, she would necessarily come between him and the earth, intercepting a portion of his rays, corresponding to her apparent magnitude, or to the angle she subtends at the eye of an observer on the earth: this interception of the light and heat of the sun from extending to the earth, is what is termed an *Eclipse* of the Sun, from a Greek word signifying want or defect. Again, on the supposition that the earth and moon moved in the same plane passing through the sun, when the moon had performed one half of her monthly revolution, and came to be directly in opposition to the sun, the earth, situated precisely between these bodies, would intercept the sun's rays from falling on the moon, and thus produce an eclipse of that luminary with respect to her, or what we commonly, but incorrectly, call an eclipse of the moon. But, as was already observed, the plane of the moon's path round the earth, crossing the plane of the earth's path round the Sun, at an angle of 5 degrees 8 minutes 48.9 seconds, eclipses can only happen when the line joining the sun and the earth meets the moon at or very near the two points where her orbit intersects that of the earth. In all other positions of these three bodies, the moon will be out of the line connecting the sun and the earth, so that neither can she interrupt his rays from falling on the earth, nor can the earth interrupt his rays from falling on the moon.

The earth and the moon being both opaque bodies, neither affording nor transmitting any light but what they receive from the sun, when the earth comes in between the

sun

sun and the moon, she ought to be entirely deprived of light, and consequently invisible to us: this, however, is not the case, and for this reason, that the rays of the sun, in passing through our atmosphere, are refracted or bent inwards towards the body of the earth, and following this new direction, fall upon the face of the moon, which thus becomes faintly visible. It is also a common thing in frosty or other very clear weather, when the moon is a few days old, and only a small part of her enlightened face is turned towards us, for the part unenlightened to be also perceptible, of a faint brown complexion: this again is the effect of the sun's light reflected to her from the earth, which performs to the moon in that respect the same office as the moon performs to the earth, but with much greater effect, for the surface of the earth being about thirteeen times as great as that of the moon, the earth-light reflected to the moon must be about thirteen times as great as the moonlight reflected on the earth.

From the moon's presenting to us the same appearance, in whatever part of her orbit she may be, it follows that her rotation on her axis must be performed in precisely the same time as her revolution round the earth; or, that she turns on her axis once in the course of one month. Hence it follows that only one-half of the moon's surface can receive any benefit from the sun's rays, as reflected from the earth, or from what an inhabitant of the moon would call earth-light, and that those who dwell on the opposite side of the moon, when turned away from the sun, can have no other light than such as we possess from the stars in a moonless night. By this peculiarity of the moon's rotation and revolution in the same time it also happens that only the inhabitants of one-half of the moon have ever seen our globe; and to these it must be a journey of no small interest to travel over a part of their own globe, in order to have a view

of the earth, and to enjoy the splendour of its reflected light. By observing the rotation of the earth on its axis, which may easily be done from the regular appearance and disappearance of the darker and brighter spots on its surface, the inhabitants of the moon are provided with a convenient and accurate mode of measuring their time, and dividing their own day equal to one of our months, into small portions equal to one twenty-ninth or one thirtieth part of their day.

The conjectures of ingenious men respecting the nature of the moon, and particularly of her surface, have been various and opposite: but the opinion now generally entertained is that the dark parts which we observe are water, or at least some substance of that nature, because water we know absorbs instead of reflecting the rays of light; but in these dark parts good glasses have discovered hollows and pits of various shapes and magnitudes, preserving an uniform position and appearance, which could not be the case did the dark parts consist of a fluid like water. Other observers however have suggested that in these bodies of water, or similar fluid, islands may exist, containing pits and hollows visible to us. That the moon however possesses many mountains, of considerable elevation in proportion to her diameter, seems to be beyond a doubt. If, with a good telescope, we observe her surface when three, four, or five days old, we perceive, besides the entirely illuminated portion, a number of bright spots or points situated within the immediately adjoining dark part. Continuing our observation for some time, we discover those bright spots gradually to increase in size, and at last the space where they were situated becomes wholly enlightened, uniting with the part at first enjoying the sun's rays, whilst fresh bright spots continue to present themselves in regular succession, as the moon in her course round us shews

 the

the several parts of her surface to the sun. These appearances are similar and analogous to what is observed on the earth; when the sun first rises upon our horizon, the tops of the highest mountains are the first gilded by his rays; but as the earth performs her rotation on her axis, these points turning gradually more and more towards the sun, his light falls lower down the mountain sides, until the whole, with the vallies at their feet, are fully enlightened, at which time lofty summits, hitherto in darkness, begin in a similar manner to receive his rays, and thus by regular progression come to be wholly illuminated like their predecessors. Astronomers, proceeding on erroneous principles, had estimated the mountains of the moon to be much more elevated than those of the earth, some being supposed to exceed nine English miles in height, nearly three times that of the highest of our summits; but later and more accurate observations make it evident that the elevation of the lunar mountains has been greatly over-rated, and that, with a very few exceptions, their general height does not exceed one-half of an English mile, while the highest summit, hitherto measured, rises to about a mile and a half. From certain peculiarities in the appearance of the lunar mountains it is probable that some of them are volcanoes. Herschel, in 1787, observed one of these in a state of eruption, the diameter of the burning part being not less than three miles: the appearance of the actual fire or volcanic eruption he compared to a small piece of burning charcoal, covered by a very thin coat of white ashes, as frequently happens when it has been some time burning: This fire had a degree of brightness about as strong as that with which such a piece of coal would be seen to glow in faint day-light; all the adjacent parts of the volcanic mountain seemed to be illuminated by the eruption, in a greater or less degree as they lay nearer to or more remote from the volcano.

Whether

Whether the moon has any fine fluid enclosing her body, similar to our air, has long been a subject of discussion among astronomers; but whether she has or has not any atmosphere, it is now generally allowed that it is to our senses almost entirely insensible.

That the moon has a very important influence on this earth, in various respects, has long been a received opinion: not only the state of the weather, it is supposed, in a great measure depends on or may be foretold by her constantly changing appearances; but even the human mind is so far subjected to her power, that those unhappy persons who are periodically deprived of the use of their rational faculties, and restored to the enjoyment of them, are even in the language of our legislation styled *lunatics*, from the Latin term luna signifying the moon. By some curious investigations inserted a few years ago in the Transactions of the Royal Society of London, the influences of the moon on our atmosphere are shewn to be very unimportant indeed; and the notion of her effects on the rational faculties of human beings seems to have arisen solely from a fancied correspondence in the periods of sanity and insanity with the periodical motions and phases of the moon. One effect, however, produced by the moon on the earth, is a matter of more consequence, because its appearances are constant regular and susceptible of accurate computation. This effect is the change produced on the surface of the sea, rising and falling in an uniform manner, agreeably to the position of the moon with respect to the earth and to the sun. This rising and falling of the surface of the sea we call the *tide*, a phænomenon equally curious in itself and useful to mankind in promoting mutual intercourse and advantage, by means of navigation and commerce.

The true cause of the tide was pointed out by the celebrated German philosopher Kepler, about two hundred

years

years ago: but it was reserved for the immortal Newton to furnish a complete and satisfactory explanation of that very curious natural phænomenon. He shewed that a property existed in nature, by which all bodies and their component particles mutually attract each other, in the direct proportion to the quantities of substance in them, but in the inverse proportion of the squares of their distances asunder. This property, called universal gravitation or attraction, produces this effect, that the parts of the sea directly turned towards the moon are drawn upwards from the usual level of their surface or in other words are drawn farther away from the centre of the earth, and consequently must be accumulated to a greater depth than usual on the side next to the moon. Again, the solid and central parts of the earth being more dense as well as nearer to the moon than the fluid parts of the sea, on the opposite side, which is turned away from the moon, these solid parts will be more powerfully attracted towards her than the more remote fluid parts; hence these fluid parts will in a certain sense be forsaken by the solid parts, and the sea will increase in depth, as much by the retiring of its bottom as if the surface had been raised above its ordinary level; and consequently there will be two risings and two fallings of the tide in one rotation of the earth on its axis, from one conjunction with the moon to another, in a little more than 24¾ hours. When the waters of the sea rise, they are said to flow, and when they fall they are said to ebb; the greatest elevation is called high water, and the greatest depression low water.

The sun greatly exceeding the moon in magnitude, the attraction of the particles forming his body ought to have a much more powerful effect on the earth than the mass of the moon; but the sun's distance from the earth is so great, in proportion to that of the moon, that the effects of his attraction

attraction are scarcely perceptible: such, however, as these effects are, they contribute, when the moon's attraction is exerted in the same direction, as at the new moon, to produce in general a higher tide than at the full moon, when these two bodies are on opposite sides of the earth, and the attraction of the sun acts in diminution of that of the moon. The high tides produced at the new and full moon are called spring tides; but at the first and third quarters of the moon, when she comes to the meridian of any place nearly 6½ hours after the sun, their attractions counteract each other, and the difference between high and low water is the least possible; these are called neap-tides. As attraction requires some time to produce its effects, so we find that the highest point of the tide occurs always at a certain period after the moon has passed the meridian of the place of observation, and this even in the open sea; but in places on narrow seas, in mouths of rivers, and other confined situations, the motion of the water is so restricted that high-water does not recur until many hours after the moon's passage from the meridians of such places. The connection, therefore, between the time of high-water and the position of the moon, determined by the time of her being on the meridian, which in the northern hemisphere of the earth is called her *southing*, is a matter of observation only: from such observations tables have been formed, indicating the period when the tide is at its greatest height on the days of the new and the full moon, in different parts of the world; and of such tables the following is a specimen, exhibiting the time of high-water on such days, in some principal positions of the British isles. The first and second column contain the names of the places; the third shews the hours and minutes when the tide is at its greatest height on the days of the new and the full moon.

PLACE

PLACE.	COUNTRY.	H.	MIN.
Aberdeen	Scotland	0	45
Agnes (St.) Lights	Scilly	3	45
Air	Scotland	10	30
Alban's (St.) Head	England	8	30
Alderney Island	——	0	00
Andrew's (St.)	Scotland	2	00
Beachey Head	England	10	00
Belfast	Ireland	10	00
Berwick	Britain	2	30
Bressay Sound	Shetland	10	00
Bridlington-bay	England	3	50
Brightelmstone	England	9	50
Bristol	England	6	40
Buchan Ness	Scotland	0	00
Caernarvon	Wales	8	30
Clear (Cape)	Ireland	4	30
Cork	Ireland	6	30
Cowes	England	10	30
Cromarty	Scotland	11	40
Dartmouth	England	6	30
David's (St.) Head	Wales	6	00
Dingle-bay	Ireland	3	30
Douglas	Isle of Mann	10	30
Dover	England	11	30
Dublin	Ireland	9	15
Dunbar	Scotland	2	30
Dundee	Scotland	2	10
Dungarvon	Ireland	4	30
Exmouth	England	6	20
Falmouth	England	5	30
Fifeness	Scotland	2	00
Flamborough Head	England	3	40
Foreland, N.	England	10	20
Ditto, S.	England	10	20
Galway	Ireland	3	00
Glasgow (Port)	Scotland	11	30
Gravesend	England	1	30
Greenwich	England	2	40
Greenock	Scotland	11	30
Guernsey Island	——	1	30
Hangcliff	Shetland	9	30
Harwich	England	11	15
Holyhead	Wales	9	45
Holy Island	England	2	30
Hull	England	6	00
Jersey Island	——	0	30

PLACE.	COUNTRY.	H.	MIN.
Inverness	Scotland	11	50
Kinsale	Ireland	5	15
Kirkcaldy	Scotland	2	20
Land's end	England	4	30
Leith	Scotland	2	20
Limerick	Ireland	4	30
Liverpool	England	11	15
Lizard Point	England	5	30
London	England	3	00
Mary's (St.)	Scilly	3	45
Milford	Wales	5	15
Montrose	Scotland	1	30
Newcastle	England	3	15
Nore (The)	England	0	00
Orfordness	England	9	45
Peterhead	Scotland	0	00
Plymouth	England	6	00
Portland Island	England	7	30
Portsmouth	England	11	15
Ramsay	Isle of Mann	10	30
Ramsgate	England	10	30
Rothesay	Scotland	11	00
Rye	England	11	15
Scarborough	England	3	45
Sligo	Ireland	5	30
Southampton	England	0	00
Spurn Point	England	5	20
Stockton	England	3	30
Swansea	Wales	6	00
Tay-bar,	Scotland	2	00
Thames-mouth	England	1	30
Tinmouth	England	3	00
Tobermory	Scotland	5	30
Torbay	England	6	15
Weymouth	England	7	20
Whitby	England	3	20
Whitehaven	England	11	15
Yarmouth (Norfolk)	England	9	00
Youghal	Ireland	4	30

By

By this table we observe, that on the days of the new and the full moon it is high water at London about 3 o'clock; and as the tide requires some time to make its way up the Thames, we find high water occurring the earlier as we go down the river, for at Greenwich the tide is at its height about 40 minutes past two, and at Gravesend so early as half an hour past one. The period of high water at the island of Alderney, at Southampton, &c. being marked 0 H. 00 min. points out that the tide there is full about mid-day and mid-night.

The height to which the tides rise in the great oceans it is difficult to ascertain for want of proper land-marks by which to measure its elevation: but in many parts where the currents are confined in their course, the difference between the full and the ebb is very considerable: thus along the coasts of Britain and Ireland the highest tides rise in general from 10 to 15 feet: but in the mouth of the Severn they rise much higher; on the coast of the island of Jersey spring tides flow from 30 to 40 feet; and in the bay of Fundy, between Nova Scotia and New Brunswick, they attain a height of from 50 to 70 feet.

In the introduction to the treatise on Geography, (pages 7 and 14 of this volume) it was observed that, by the rotation of the earth on its axis, the phænomena of light and darkness constituting what we call a day were produced; that had the earth's axis been placed perpendicularly on the plane joining the earth and the sun, the globe would have been illuminated by the sun's rays constantly in the same manner all the way from the north to the south pole, and the days and nights produced from the earth's diurnal revolution, by which all parts of its surface are successively exposed to his light, would have been constantly of the same

length

length throughout the year;—that in such a state of things no sensible variation in the quantities of heat and cold constituting that interchange of seasons we now experience, especially in regions remote from the equator, would have been perceived; but that from the oblique position of the earth's axis with respect to her orbit arise the regular changes in the length of the day and the night, and in the degree of heat and cold by which the seasons are so happily diversified and characterised.

The earth in her annual course round the sun describes a path called the ecliptic, which if observed from the sun would appear to pass by certain fixed stars or clusters of stars: if parallel to this path or line be drawn two other circles, one on each side at the distance of 8 degrees, a band or zone in the heavens will be determined in breadth 16 degrees, within the limits of which not only the earth but all the other planets hitherto discovered and our moon will describe their course. This zone passing through a number of constellations or clusters of stars, chiefly named after some animal, has hence been called the *zodiac*, from a Greek term ſignifying a living being or animal. These constellations are twelve, and usually styled the signs of the zodiac: their names and the characters by which they are designated are the following, viz.

TABLE.

1	2	3	4	5	6
Aries. Ram.	*Taurus.* Bull.	*Gemini.* Twins.	*Cancer.* Crab.	*Leo.* Lion.	*Virgo.* Virgin.
♈	♉	♊	♋	♌	♍
7	8	9	10	11	12
Libra. Balance.	*Scorpio.* Scorpion.	*Sagittarius.* Archer.	*Capricornus* Goat.	*Aquarius.* Water-bearer.	*Pisces.* Fishes.
♎	♏	♐	♑	♒	♓

Of these signs the first six are called the northern signs, as lying in that portion of the ecliptic which is situated on the north side of the equator, and the remaining fix are called the southern signs, as lying on the south side of the equator; each sign being the 12th part of a great circle or of 360 degrees will contain 30 degrees.

In fig. 2d of Astronomy let the ellipse ECLP represent the plane of the Earth's orbit described by her annual motion round the sun. It has already been said that this plane is inclined to that of the earth's equator, intersecting it at an angle of 23 degrees 28 minutes 10 seconds: and that consequently the axis on which the earth performs her daily rotation being perpendicular to the plane of her equator must be inclined to the plane of her orbit or of the

the ecliptic at an angle of 66 degrees 31 min. 50 seconds. Let the four globes in the figure represent the Earth in four different equidistant points of her orbit, and let the line joining the globes No. 1 and 3 represent the line of the intersection of the plane of that orbit with the plane of the equator. On the globe of the Earth N is the north pole, and S is the south pole; NS is the axis, AC is the arctic circle, TR the antarctic circle, ♋ is the tropic of Cancer, ♑ the tropic of Capricorn; ÆQ is the equator, forming with the ellipse ECLP at the Earth's center an angle of 23° 28′ 10″: the Sun is placed in the center of the Earth's orbit and on the line of intersection of the ecliptic and the plane of the equator.

When the Earth is in the position No. 1. at the point of intersection of these two planes, her axis, always perpendicular to that of her equator, must of course be likewise perpendicular to the place of her orbit, which passes through the Sun, whose light must then illuminate the whole extent of her body from the north to the south pole; the rays from his centre falling perpendicularly on the Earth's equator: if the Earth revolve on its axis in this position, all parts of her surface will be equally exposed to the Sun's rays, and consequently the day and the night will be of equal length all over the globe; hence, the Earth is at such times said to be in the equinoctial points of her orbit, and the periods when this happens are called the equinoxes; the one occurring about the 20th of March, when the Earth, if observed from the Sun, would be entering the sign Libra, and the other about the 23d of September, when the Earth would appear at the beginning of the sign Aries. But when the Earth is in any point of her orbit the Sun must appear in another point diametrically opposite to it; when therefore the Earth is in the beginning of Libra, the Sun will apparently, as seen from her, be in the begining of Aries; and when the Earth is entering Aries, the Sun will be apparently entering Libra: hence,

hence, it is in customary language said, that about the 20th of March the Sun enters the sign Aries, and about the 23d of September he enters Libra. The first of these periods is the vernal and the last is the autumnal equinox.

Let now the Earth proceed in her annual course until she arrive in the position No. 2, which is distant from the former one fourth part of her orbit, corresponding to the beginning of the sign Capricorn, when the Sun will appear to be entering the sign Cancer. Her axis invariably preserving the same position in all parts of her orbit, or in other words, being every where parallel to itself, it will now (as may be seen in the figure) have acquired a different position with regard to the Sun, leaning as it were towards him, so that instead of being in the plane, passing through her equator, he will be in one, passing through a point on her surface, $23\frac{1}{2}$ degrees to the northward of it, as at ♋; on which a ray from his centre will fall perpendicularly, and his light still, as in the position No. 1. illuminating one half of the Earth's surface, the illumination will extend beyond the north pole N, just as far as the perpendicular ray from the Sun's centre falls to the northward of the equator, that is $23\frac{1}{2}$ degrees; and consequently, instead of reaching to the south pole S, the illumination will fall short of it by $23\frac{1}{2}$ degrees, and the boundary between light and darkness will be indicated by the line or circle AR (No. 2). As the plane of this bounding circle passes through the centre of the Earth all places situated on the equator will still have the day and the night of equal length: but all places situated within the arctic circle, described at the distance of $23\frac{1}{2}$ degrees round the north pole, will enjoy continual day-light; and all intermediate places between the equator and the arctic circle will have the day and the night more or less of equal duration, according to their position towards the first or the last of those circles: thus if LOD be the parallel of latitude on which

which London lies (see No. 2), LO will represent the length or duration of the night, and OD will show the length of the day, when the Earth is entering Capricorn, or when the sun is entering Cancer, which happens about the 21st day of June. The reverse of there appearances occurs in places situated in southern latitude, where the figure shows the nights to be at this juncture all longer than the days, increasing by regular gradation until at the antarctic circle T R, the illuminated part of the Earth's surface ceases, and all places situated within that circle must be involved in constant darkness.

As the Earth in her progress from the vernal equinox, at No. 1, to the position at No. 2, gradually brings the north pole N more and more within the scope of the Sun's rays, so in her course from this last point to the position No. 3, that pole falls regularly back towards the boundary of light and darkness AR, and at last on arriving in the point indicated by No. 3, that boundary coincides with a plane passing through the Earth's axis, and the illumination extends from pole to pole as was the case at the vernal equinox No. 1. When the Earth is in the position No. 2, the progress of the illumination ceases, and hence that period is called the summer solstice (Geography, page 15.) The position of the Earth represented at No. 3, occurs about the 23d of September, when the plane of the circle of light and darkness passing through her axis, the day and the night are of the same length: hence this period is called the autumnal equinox, the Earth then entering the sign Aries, or the Sun apparently entering Libra.

After describing another quarter of her annual orbit the Earth comes to be in the position indicated by No. 4, when entering the sign Cancer the Sun appears to enter the opposite sign Capricorn: this happens about the 22d of December. In this position the axis of the Earth still preserving its direction with respect to itself, the north

pole

pole N is turned away from the Sun and the south pole verges towards him, so that it comes now to be advanced within the illuminated part precisely as much ($23\frac{1}{2}$ degrees) as six months before in the position No 2, it was retired. In this state of the globe it is evident that no part contained within the arctic circle AC can by the Earth's diurnal rotation be brought under his rays, while places situated within the antarctic circle TR will never be deprived of his light. All places therefore lying in southern latitude will in this position of the Earth have the day longer than the night proportionally to their distance from the equator, that is to their latitude: the southern hemisphere will consequently be in the enjoyment of summer while the northern is plunged in the depth of winter. The Earth being now arrived at that point of her orbit which is the farthest removed from the plane of her equator she begins to return towards the point where these two planes intersect each other, and the Sun apparently standing still, this period is called the winter solstice. In this manner the Earth continues her course until about the 20th of March, arriving at the first point of Libra, and the Sun appearing to be in the beginning of Aries, the Earth's axis becoming again perpendicular to the line of intersection passing through the Sun, his rays illuminate the whole hemisphere from pole to pole, and the days and nights being of equal length, the Earth assumes the appearance represented by No. 1 in the figure, where we began to consider her annual course.

The regular succession of night and day, of winter and summer, of spring and harvest, in the other planets of the solar system are produced in the same way as in our Earth.

COMETS.—Besides the celestial bodies already described which perform their stated revolutions round the Sun, or round the primary planets to which they are attached, another

another set of bodies are observed to make their occasional appearance in our quarter of the universe, moving with various degrees of rapidity and in paths of a very different nature from those of the solar planets. These bodies are called *Comets* from a Latin term signifying hair, because they are generally attended by a bright beard or tail, which in whatever part of their course they are observed, is always turned away from the Sun.

The paths in which the Comets move approaches so much to a straight line pointing towards the Sun, that they seem to be intended to fall upon his body; they are however observed to appear a second time on the opposite side of that luminary, receding from him with a velocity at first equal to that with which they approached, and the tail much increased in magnitude and brilliancy. It was long supposed that Comets really did move in straight lines to a point near the Sun's body, from which returning in the same kind of tract they passed beyond the bounds of our system, never more to re-appear; but from observations on a very remarkable Comet which visited us in 1680, Sir Isaac Newton ascertained that its path, in no part a right line, was in fact an ellipse or curve of the same species with the paths of the planets, only extremely excentric, the greater diameter bearing a very great proportion to the less, and that the Sun was in one focus of this ellipse while the other was removed at an inconceiveable distance, but still much nearer to the Sun than to any of the fixed Stars, so that the Comet must always continue its revolutions round his body. In proportion to the great elongation of their orbits, the velocity with which comets proceed is subject to great variation, their rapidity when near the Sun being inconceivably greater that when they are in the opposite part of their orbit. Comets have in ignorant times been supposed to be only temporary meteors formed and kindled in the lower regions of the terrestial atmosphere;

many have imagined them to be commissioned to announce to mortals, war, pestilence, or some other dreadful calamity: better observations however and wiser judgments have at last restored them to their due station in the universe, and comets are now acknowledged to be opaque bodies of a spherical form, similar to this earth or any other of the planets, possessing no light but what is produced by the sun.

Comets to the eye unassisted by glasses, appear like a star shining through a cloud, or in a fog; but by means of a telescope, present the appearance of a solid globe, with an atmosphere surrounding it to a great distance, in proportion to the diameter of the globe: this central body is called the *nucleus* or kernel of the comet. It has been observed, that in proportion as comets approach the Sun, the atmosphere inclosing them is diminished, while the tail is increased, and on the other hand, that as they retire from the Sun, the tail is diminished and the atmosphere increased; hence it is evident that the tail or luminous substance, accompanying the comet, is in one way or other produced by the action of the sun, on the body of the atmosphere of the comet. Many theories have been suggested to explain the nature and causes of the tail of a comet, but nothing beyond conjecture can as yet be offered on the subject. From the various appearances assumed by comets in different parts of their orbits, it becomes extremely difficult to ascertain, whether on their reappearance they are the same or different from those formerly observed; besides from the position of the earth, with respect to the comet and the sun it may frequently happen that a comet may turn round the sun, and even pass near the earth in the day time, so as not to be visible to us, and consequently the period of its revolution being unnoticed, must remain unascertained.

FIXED STARS.—The stars are readily distinguished from the planets, not only by their constantly remaining in the same

same position relatively to one another, but by the bright twinkling light they emit. This light occasions them to appear much larger than when observed through a telescope, which excludes all rays but those proceeding from the star itself; and the brightest star seen from the earth, presents a diameter, scarcely susceptible of measurement. On account however of their various apparent sizes, the stars are arranged in different classes, those of the greatest brilliancy and apparent size being called stars of the first magnitude, those next in brilliancy and apparent size are called stars of the second magnitude, and so on to the fifth and sixth magnitudes, which are the smallest perceptible to the naked eye in clear weather: smaller stars only discoverable by glasses are termed telescopic stars.

In the earliest times, astronomers for the better knowledge of the stars, distributed them into a variety of figures, termed clusters of stars, asterisms or constellations, named after different persons, animals, or other objects of celebrity in those days; and by means of these constellations, the position of any star can be as readily ascertained as that of any town on a map of the globe of the earth: of these constellations the twelve signs of the Zodiac already mentioned are a portion, the antients dividing the whole heavens into about forty-eight constellations, to which, in later times, about twenty-four have been added.

Of the nature of the stars we can judge only from analogy, supposing each to be a sun immoveable in its place, possessing intrinsic power of affording heat and light to a number of opaque globes revolving round it, as the earth and the other solar planets do round the sun: and if we suppose the stars to be all of the same magnitude with the sun, and with each other, then their different apparent magnitudes must be occasioned by their different distances from our system: the nearest star to us, as for example, Sirius or the Dog star, one of the brightest, is imagined to be

 not

not less than four hundred thousand times farther from the sun than we are. To form some notion of the vast distance even of Sirius it is sufficient to consider, that if his position with respect to other stars be observed when the earth is in any fixed point of her orbit, and also when after six months she has arrived in a point diametrically opposite to the former, no sensible change in the relative position of Sirius and the adjoining stars can be perceived, although the earth has changed her position in the heavens the whole diameter of her orbit, or twice the distance from her to the sun.

Milky way.—Besides the brilliant appearance of the stars the heavens are begirt by a broad swathe or belt of whitish light, divided in some parts into two: this from its colour is called the galaxy or milky way, and is produced by the accumulated light of an innumerable multitude of stars too small or too remote to be distinguished by the naked eye. Whatever may have been the original structure of the universe at its first coming into existence, it seems now evident that the stars themselves are not placed or fixed at equal distances the one from the other in every direction, but that they are distributed into layers or strata of vast extent in length and breadth; but of more confined thickness or depth. If this be the case it will naturally follow, that the stars of one of these strata will, to an observer looking at them laterally, appear much more closely situated than to one who looks at the stratum on its broad surface. Since then by examining the milky way we discover not only a great accumulation of light but also a prodigious assemblage of stars, and this enclosing us like a circle extended in all directions, it is but rational to conclude that we ourselves are situated within the limits of the stratum of stars termed the milky way, and that our sun is only one of the stars of that stratum.

In various parts of the heavens are likewise discovered bright spots entirely similar in appearance to the Galaxy, which

which when examined by glasses present in the same manner clusters of stars at a great distance, whose assembled light is the cause of the brightness we perceive: these spots are from their cloudy look called *nebulæ*.

The antient astronomers have mentioned stars in certain parts of the heavens, which are now no longer to be seen: and even in later times, stars have been observed gradually to increase in brilliancy and magnitude to a certain point, and then gradually to diminish to another point, whence they returned to their original brightness; others again have entirely disappeared for a long series of years, and periodically resumed their place in the firmament. Repeated and accurate observations have ascertained that such variations in the appearances of the stars do rarely happen, but the causes of these variations are hitherto beyond our reach.

Although the stars have for the purpose of the more readily ascertaining their positions been distributed into signs and constellations, still a more precise determination of their several places has been requisite; and this is obtained by means of referring their situations to certain imaginary points and lines in the heavens, in a way corresponding to the method of determining the situation of places on the face of this earth, with respect to latitude and longitude.

Let us suppose the axis of the earth to be produced indefinitely to the heavens, and the plane of the earth's equator likewise indefinitely extended, if then a circle be imagined to pass through the two poles of that axis, and through the centre of any star or other heavenly body, the space intercepted between this body and the heavenly equator will measure how much the body falls off, or declines from the equator, or it will express the *declination* of that body, and the circle passing through the body and the poles is termed a circle of declination: the declination being either north

or

or south, accordingly as the heavenly body is situated on the north or the south side of the equator.

Having thus obtained the position of a star, &c. in northing and southing, it is requisite also to determine its position in easting or westing, and for this purpose, if a circle of declination be supposed to pass through the poles and to intersect the equator at the points where it, crosses the plane of the ecliptic or of the earth's annual path at the time of the vernal and autumnal equinoxes, this circle may be considered as a first meridian, from which the star's distance, east or west, is to be determined, by measuring the distance on the equator, intercepted between this first meridian at the points of the vernal equinox, and the circle of declination passing through the given star. This space on the arch of the equator between the point of the vernal equinox, and the circle of declination of any heavenly, is called the *right ascension* of that body.

Again, the position of a star may be determined with respect to the ecliptic in latitude and longitude; the latitude being measured on a great circle passing through the poles of the ecliptic and the star, and the longitude being the arch of the ecliptic, intercepted between that circle and the point of intersection of the ecliptic and the equator at the vernal equinox, or from the first point of the sign Aries, and both the longitude and the right ascension are calculated according to the order of the signs, formerly pointed out, from 0° to 360°.

It had long been observed that although the stars seemed to retain their position with respect to latitude or their perpendicular distance from the ecliptic, yet, that their declination and right ascension underwent a certain degree of alteration. This could only be accounted for, by supposing that the first point of the sign Aries, or that where at the vernal equinox the plane of the equator intersected the plane of the ecliptic, changed its place with respect to the

the stars; or in other words that the axis of the equator did not uniformly maintain its position relatively to that of the ecliptic, but that the poles of the equator performed a sort of revolution round those of the ecliptic, by which the places of the intersection of these two planes were continually changing. These observations were made so far back as in the time of Hipparchus, about 150 years before Christ, and even by the Chaldean and Indian astronomers at a much earlier period. Hipparchus discovered that in his time the point where the equator crossed the ecliptic at the autumnal equinox was situated about 6 degrees to the eastward of the bright star called *Spica Virginis* in the constellation Virgo: he drew, also, from observations made 150 years before his own time that the point of the same equinox was then about 8 degrees to the eastward of that star: from these and other discoveries he concluded that the equinoctial points in the heavens were not fixed, but that they moved to the westward about 2 degrees in 150 years, or 1 degree in 75 years, or 48 seconds in one year. Subsequent observations, however, have shown that this motion of the equinoxes amounts to about $50\frac{1}{3}$ seconds of a degree in every year: so that if the heavenly equator cut the ecliptic at any given point or any given day of one year, it will on the same day of the following year cut in $50\frac{1}{3}$ seconds to the westward of the former point; and the earth will come to the equinox 20 minutes 23 seconds before she has completed her circuit round the heavens from one star to the same again. Hence, we see the reason for the difference between the tropical or equinoctial year and the sidereal year, as stated in the table formerly given of the motions of the solar planets where the tropical year is marked 365 days, 5 hours, 48 minutes, 49 seconds, and the sidereal year 365 days, 6 hours, 9 minutes, 12 seconds, their difference being as above 20 minutes, 23 seconds.

This motion of the equinoctial points is called the

precession

precession of the equinoxes, because the earth's position at those points precedes the calculations.

The signs of the zodiac formerly coincided with the constellations from which they draw their names, but by the precession of the equinoctial points of the earth's orbit, the stars of the constellation Aries at this time, in fact, occupy the sign or space of 30 degrees in the ecliptic, which we call Taurus, the constellation Taurus occupies the sign Gemini, and so on to the constellation Pisces, which now fills the sign Aries.

The limits of this work preclude the possibility of enumerating and illustrating all the valuable purposes to which astronomy is applicable in the occurrences of ordinary life; all therefore that can be attempted is to point out some of its uses in two very important departments of human knowledge, Chronology, or the art of measuring time, and by it duly arranging the succession of events from the earliest periods, and Navigation, or the art of conducting vessels from one part of the globe to another, across the pathless ocean.

CHAP.

THE

MODERN PRECEPTOR.

CHAPTER VIII.

OF CHRONOLOGY.

Chronology is a term formed from two greek words, *chronos* signifying time, and *logos* a discourse. The objects of this branch of science are to measure time and arrange its several portions, as also to ascertain the date of events and adjust their positions agreeably to the order in which they have taken place.

The simplest and most natural mode of dividing time is drawn from the regular succession of light and darkness, of day and night, and from the apparent motions of the sun, the moon, or the other heavenly bodies. The term day properly signifies the time while the earth is enlightened by the sun's rays, in opposition to the night when these rays are concealed from our view; but in a more comprehensive sense, a day means the time elapsing while the earth performs one complete rotation on its axis.

The commencement of the day has, in different countries, and at different periods of history, been reckoned in very different ways. The ancient Babylonians, Syrians, Persians, and Indians, counted their days to begin at sunrise; the Jews began their civil day at the same time, but the sacred

day began at sunset; the Romans counted from midnight to midnight, the mode now adopted all over Europe, with the exception of the Venetian territory, the Papal dominions, and some other districts of Italy where it was lately the practise to begin the day at sunset, the first hour after which was one o'clock, the second hour two o'clock, and so on through the four and twenty hours to the following sunset, by which mode the hours of midnight and midday were continually varying according to the time of sunset in the different seasons of the year. The astronomical and nautical day in Europe is reckoned from the noon of one day to the noon of another, and begins 12 hours later than the civil or ordinary day: hence 8 o'clock in the morning of the 10th of February will in astronomical and nautical language be counted the 20th hour of the 9th of February, and 5 o'clock in the afternoon of 22d of November, which is the 17th hour of the common day, will be counted only the 5th hour of the astronomical day.

Among the Jews and the Romans, the day was divided into four vigils or watches, the first extending from sunrise half way to noon, the second from that intermediate point, about 8 or 9 o'clock, to noon when the third watch began and continued to 3 or 4 in the afternoon, whence the fourth watch reached to sunset: in the same way was the night also divided into other four watches. In modern Europe the day is divided into 24 equal parts called hours, each hour into 60 equal parts called minutes, and each minute into 60 equal parts called seconds. It has been found by experiment at London, in a spot elevated 113 feet above the level of the sea, when Fahrenheit's thermometer indicated a temperature of 60 degrees, and the mercury in the barometer stood at 30 inches, that a pendulum in length 39.1196 English standard inches (not 39.2 inches, as is commonly supposed) would perform its vibrations precisely in one second of time, that is vibrate 60 times in one minute,

minute, 3,600 times in one hour, and 86,400 times in one day. This length of the pendulum, from the figure of the earth an oblate spheroid of which the equatorial diameter is greater than the polar axis, will not beat seconds in all parts of the earth's surface: for as the gravitation by which the pendulum is kept in motion acts the more powerfully the nearer any body is to the center of the earth, the vibrations of a pendulum regulated for the latitude of London would be too quick at the poles, and two slow at the equator; consequently at the former station, the pendulum would require to be lengthened, and at the latter station to be shortened, in order at each to vibrate 60 times in one minute, or once in a second of time.

By observing the regular returns of the various phases of the moon in her course round the earth, was formed the notion of that extent of time called a month: and as twelve revolutions of the moon brought round the several seasons nearly to their proper place, so many months were reckoned to compose the year. The moon's revolution being divided into four equal parts, by the first quarter the full moon and the third quarter, the period of that revolution, reckoned to be 28 or 29 days, was also divided into four equal portions of seven days each, called weeks.

The ancient Greeks adopted a mode of calculating time, in which they differed not more from other people than amongst themselves. The Athenians divided the year into 12 months consisting alternately of 30 and 29 days, by this compensation agreeing with the monthly circuit of the moon; and each month was divided into three portions of 10 days each, called *dechemera* or *decades*, and in those of 29 days, one day was suppressed in the computation, so that the last was always reckoned the 30th day of the month.

In imitation of this mode of reckoning time, the late republican government of France distributed the year into

 12

12 months, each containing 30 days, adding 5 to the number in ordinary years and 6 in leap years, to complete the true length of the year. In this way however the advantages of the Greek division were lost, for the months did not correspond with the revolutions of the moon, neither were the 12 months sufficient to make up the year. The French month was also divided into three decades or periods of 10 days each.

The Romans in the time of Romulus the founder of their state, are said to have employed a year consisting of only ten months, viz. Martius, Aprilis, Maius, Junius, Quintilis, Sextilis, September, October, November, December; of which the four first have appropriated names, but the rest have names expressing their numeral order. Of these months the 1st, 3d, 5th, and 8th consisted of 31 days, and all the others of 30, so that the whole year contained but 304 days, a period very discordant with the annual course of either the sun or the moon, as well as with the regular returns of the different seasons. This irregularity was observed and in some measure remedied by Numa the successor of Romulus, who introduced two new months, Januarius of 31 days, and Februarius of 28 days, before Martius, formerly the beginning of the year, which from his time was reckoned to commence on the 1st of Januarius. This improvement however not perfectly corresponding to the course of the sun and moon, many temporary expedients were adopted to bring the year to coincide with the regular appearances of the seasons and the heavenly bodies. At last Julius Cæsar, to bring forward the several months to their proper places, formed a year of 15 months, or 445 days, which on account of the changes it produced in ordinary affairs was called the year of confusion. This year being ended, the new Julian year began on the 1st of January of the year 45 before Christ. From this time the civil year and the months were regulated by the course of the sun.

sun. Numa's year being 10 days shorter than the solar year, two days were added by Cæsar to each of the months of January, August, and December, and one to April, June, September, and November. He directed also an additional day to be introduced every 4th year after the 23d of February; or that the 6th day before the Calends, or 1st day of March, should be twice reckoned; from which circumstance of repeating the sixth day before the Calends, this 4th year was termed bissextile: amongst us it is usually called leap year, as going beyond the bounds of ordinary years.

Sundry small inaccuracies in this Julian year made it too long, so that the vernal equinox, which in Cæsar's time happened on the 25th of March, had in the year 1582 gained so much on the Calendar as to happen on the 11th of March. In this year, the reigning Pope Gregory XIII. at the instigation of many learned men, published a fresh reformation of the Calendar, in which 10 days were cut off after the 4th of October, and the 5th was reckoned the 15th of that month. To prevent the seasons from again falling back, Gregory ordered a day to be intercalated or introduced in February every 4th year; and that the 1600th year of the Christian era, and every 4th century thereafter, should be a bissextile or leap year; one day is therefore to be intercalated in the year 2000, 2400, 2800, &c. but in other centuries, as 1700, 1800, 1900, 2100, &c. it is suppressed, these being reckoned common years.

This manner of reckoning time was immediately introduced into all countries acknowledging the papal authority, and was called the Gregorian or new style: but in other countries professing the doctrines of the reformation which had by that time made considerable progress in Europe, no immediate alteration was adopted, and even in this country the new style was not employed until the year 1752, when by an act of parliament the 3d day of September was declared

to

to be the 14th of that month, and the beginning of the year was removed from the 25th of March to the 1st of January. In Russia the old style is still in use.

But after all, the Gregorian calendar is not absolutely correct: the reqnired correction however is so inconsiderable as to amount only to a day and a half to be suppressed in the course of about 5000 years.

Besides the foregoing natural divisions of time others have been devised, called cycles, from a Greek word signifying a circle, because by the revolution of these portions of time certain appearances of the heavens regularly recur. Of these periods the most important are the cycles of the sun and the moon. The solar cycle consists of 28 years, in which time the days of the month return to the same days of the week, as at the beginning of the cycle; the sun's place to the same point of the ecliptic, and the leap years to the same course with respect to the days of the week, on which the days of the month fall. The lunar cycle is a revolution of 19 years, at the end of which time the new and full moons return very nearly to the days on which they occurred at its commencement. This period of 19 years was by the antient Greeks marked in letters of gold, for which reason, as also on occount of its utility in chronological computation, it was called the golden number.

The year of our Saviour's birth, according to the common calculation, was the 9th of the solar cycle: when therefore it is required to know what year of that cycle is any given year of Christ, we add 9 to that year and divide the sum by 28, the years in the cycle, the quotient showing how many cycles have elapsed since his birth, and the remainder the year of the remaining cycle.

The first year of Christ being also the first of the lunar cycle, to find the year of this cycle corresponding to any given year of the Christian era, we add 1 to that year and

and divide the sum by 19, when the quotient shows the number of cycles elapsed, and the remainder the years of the current cycle.

If therefore to the year 1809, we add 9, and divide the the sum by 28, we have in the quotient 64 cycles of the sun, and the remainder 26 is the year of the current 65th solar cycle: again, if to the same year 1809, we add 1, and divide the sum by 19, we obtain a quotient of 95 lunar cycles; and the remainder 5 is the year of the current 96th cycle, or the golden number for the year 1809.

The epact is a number denoting the excess of the common solar year above the lunar, by which the age of the moon every year may be found: consequently a table of epacts is only a table of differences between these two sorts of years; and the epact of any year is the number indicating the moon's age in the beginning of that year according to the Calendar. If the new moon fall on the 1st of January, the epact of the ensuing year is nothing; but in the beginning of the following year it will be 11, because the lunar year is 11 days shorter than the solar; the moon must therefore have changed on the 20th of December preceding, and she will be 11 days old on the 1st January following. In the second year, the epact will be 22 days, in the third year 33 days, and so on: but as 30 days are reckoned for a month, this number being subtracted from 33, will leave 3 for the epact of the third year: hence the epacts will be the following, 0, 11, 22, 3, 14, 25, 6, 17, 28, 9, 20, 1, 12, 23, 4, 15, 26, 7, 18, 29, 10, 21, 2, 13, 24, 5, 16, 27, 8, 19, 0. This series of epacts would be correct if two lunar months were exactly 59 days, and if the civil year contained precisely 365 days, with 366 on every leap year; but this is not precisely the case.

The epact is found in this way: multiply the golden number of the year by 11, add 19 to the product, and divide the sum by 30, when the remainder is the epact: thus the

epact

epact of the year 1809 is 14. If instead of adding 19 to the above product, we subtract 11 from it, and divide the remainder by 30, the quotient will still be 14 for the epact of the year 1809.

By means of the epact and the golden number, we are enabled to calculate the time of the new and the full moon, and her age on any given day. As the period of the moon's course round the earth, or one lunation, may in round numbers be reckoned $29\frac{1}{2}$ days, it is evident that every month of the year, excepting February, must exceed the length of a lunation: if therefore we suppose the moon to be new at the commencement of the 1st day of January, the excess of that month over the lunation (or the epact for January,) will be $1\frac{1}{2}$ day, and February containing 28 days in common years, this excess added to 28 will give $29\frac{1}{2}$ days, equal to another lunation. The following new moon coinciding therefore with the beginning of March, that month which consists of 31 days, must again exceed a lunation by $1\frac{1}{2}$ day, which is the epact for March. In this manner the following table is formed, showing the expact for every month of the year.

TABLE OF MONTHLY EPACTS.

Jan.	Feb.	March	April	May	June
$1\frac{1}{2}$	0	$1\frac{1}{2}$	2	$3\frac{1}{2}$	4
July	Aug.	Sept.	Oct.	Nov.	Dec.
$5\frac{1}{2}$	7	$7\frac{1}{2}$	9	$9\frac{1}{2}$	11

To find the time of the new moon in June, 1809; for instance, we add to the epact of that year, already found to be 14 days, the epact or number for May, the month immediately preceding June, viz. $3\frac{1}{2}$ days; and the sum

$17\frac{1}{2}$

$17\frac{1}{2}$ taken from 30 will leave $12\frac{1}{2}$ days of June, for the time of the new moon: but as in astronomical computation the day begins at the noon after the commencement of the common day, $12\frac{1}{2}$ days will coincide with the beginning of the 13th day of the month; and in fact, the true time of new moon is found, by accurate calculation, to happen about 4 in the morning of the 13th of June, 1809.

Were it required to discover the moon's age on any given day, as the 25th of June of the same year, we have only to count the days from that of the change, and the difference 12, is the moon's age on the given day.

Again, to find the age of the moon on Christmas-day, 1809, we add together the epacts for the year or 14, for the month preceding December or $9\frac{1}{2}$, and the day of the month 25, making together $48\frac{1}{2}$ days, from which subtracting 30, the remainder gives the moon's age $18\frac{1}{2}$ days, for 25th December, 1809.

In almanacs, it is usual to place certain letters of the alphabet before the several days of the months: these are the letters, A B C D E F and G, seven in number, equal to the days in the week. The first day of January is always marked A, the second B, and so on to the seventh, G, then the eight day begins with A, the ninth is B, and the 14th G as before. If the first of January be a Sunday, then will the eighth day be also a Sunday, and marked A in the calendar: hence A will through the whole year denote the Sundays, and so be called the Sunday or dominical letter for that year. Had every year consisted of 364 days or 52 weeks, it is evident that the year would always have begun on the same day of the week, and that the dominical or Sunday letter would always have been the same: but common years consisting of 365 days, if the year begin on a Sunday, it will end on the same day, and the following year will begin on a Monday; consequently if the dominical letter of the

 first

first year be A, that of the second year will be G. In leap years however consisting of 366 days, if the first day be Sunday or A, the last day will be Monday or B, and the first day of the ensuing year will be Tuesday, and the dominical letter will be F. In leap-years, also, are two dominical letters, the first serving from the beginning of the year to the end of February, and the second for all the rest of the year. This is occasioned by the intercalation of a day, counted the 29th of February: to which is given the same letter with that of the 28; for if the first of January were Sunday, and A the dominical letter, the 28th of February would fall on Tuesday the 3d day of the week or C, and the 29th or Wednesday, being intercalated with the same letter C repeated, Thursday the 1st of March will be D, Friday E, Saturday F, and Sunday will be G. By this process we find for the leap-year two Sunday or dominical letters A and G, the former to be used in January and February, and the latter in all the other months of the year.

The preceding rules give the yearly and monthly epacts in round numbers, near enough the truth for ordinary purposes: in the following tables, however, they are stated agreeably to accurate computation, in days, hours, and minutes, for the years 1808 to 1850, both included.

YEARLY EPACTS.

YEARS.		EPACTS. d.	h.	m.	YEARS.		EPACTS. d.	h.	m.
B	1808	3	0	55		1830	5	17	14
	9	13	16	6		1	16	8	26
	10	24	7	18	B -	2	27	23	37
	1	5	9	45		3	9	2	4
B -	2	17	0	57		4	19	17	16
	3	27	16	8		5	0	19	43
	4	8	18	35	B -	6	12	10	55
	5	19	9	47		7	23	2	6
B -	6	1	12	14		8	4	4	34
	7	12	3	26		9	14	19	45
	8	22	18	37	B -	40	26	10	56
	9	3	21	4		1	7	13	24
B -	20	15	22	16		2	18	4	35
	1	26	3	27		3	28	19	47
	2	7	5	55	B -	4	10	22	14
	3	17	21	6		5	21	13	26
B -	4	29	12	18		6	2	15	53
	5	10	14	45		7	13	7	4
	6	21	5	57	B -	8	24	22	16
	7	2	8	24		9	6	0	43
B -	8	13	23	35		1850	16	15	55
	9	24	14	47					

In this table the years to which the letter B is prefixed are bissextile or leap-years.

MONTHLY EPACTS.

MONTHS.	EPACTS. d.	h	m.	MONTHS.	EPACTS. d.	h.	m.
January	0	0	0	July	3	19	36
February	1	11	16	August	5	6	52
March	29	11	16	September	6	18	8
April	1	9	48	October	7	5	24
May	1	21	4	November	8	16	40
June	3	8	20	December	9	3	55

N. B. In leap-years one day must be subtracted from the sum of the epacts in the months of January and February.

 These

These tables contain the mean epacts on the supposition that the moon's motion in her orbit is regular and equable, and performed in the time of 29 days 12 hours 44 minutes 3 seconds.

For determining the dates of events in the world, various epochs or points of time from its commencement have been selected. The principal of these is the creation of this world, which according to the best computations of the learned, took place about 4008 years before the beginning of the Christian era. In this determination modern chronologers have been confined to follow the Mosaic history in the old Testament, which independently of its divine original contains the only rational and consistent account of events from the earliest periods of time, any where to be found; for the histories of the Chinese, the Egyptians, the Babylonians, the Indians, and other nations laying claim to the highest antiquity are evidently filled with the grossest contradictions and absurdities.

Our common era reckoned from the birth of our Saviour was not adopted until so late as about the year 527, when Dionysius, abbot of a monastery in Rome, first settled and introduced that mode of counting time. In settling this point, however, it appears he committed an error of 4 years, placing Christ's birth so much later than the truth: if then the Creation took place 4004 years, as is generally computed, before the birth of Christ, it must have happened 4008 years before the commencement of the Christian era; and the year 1809 ought in strictness to be counted the 1813th year from the birth of our Saviour. When therefore we speak of any event as occurring in any given year of Christ we mean such a year of the Christian era as settled by Dionysius, and by adding 4 to the number we obtain the year from the true epoch of our Saviour's birth.

The Greeks made use of a period called an Olympiad, which was a space of 4 years, at the end of which were celebrated

celebrated the Olympic games, near the city Olympia on the western coast of the Peloponnesus. These games were said to have been instituted by Hercules in honour of Jupiter: but being afterwards discontinued for a time, they were revived in the year 776, before the Christian era, from which time they were celebrated every 5th year without interruption; and computation by Olympiads may be traced in the history of Greece down to the 440th year of Christ.

Amongst the Romans it was the practice to date events from the year of the foundation of the city, corresponding to year 753, before the Christian era.

The Arabians, Turks, and many other oriental nations, reckon their time from the flight of Mahomet from Mecca to Medina, which happened in the year 622 of the Christian era: but the Persians compute by the era of Jesdegird, beginning in the year 632.

The following is a list of a few of the most important events in the history of the world, from the creation to the present time:

	Year before the common Christian era.
The Creation - - - -	4008
The deluge or Noah's flood - - -	2352
The calling of Abraham - - -	1985
Moses born - - -	1571
Cecrops founds the kingdom of Athens - -	1556
Cadmus carries Phœnician letters into Greece -	1493
The Pentateuch or first five books of Moses written	1452
Tyre built - - - -	1252
Carthage founded by the Tyrians - -	1233
Destruction of Troy - - -	1184
Dedication of Solomon's temple at Jerusalem -	1008
Era of the Olympiads began - - -	776

Era

	Before Christian Era.
Era of the building of Rome - - -	753
Maps and globes introduced into Greece by Anaximander	600
Tarquin the proud, the last king of Rome, expelled	509
Xerxes' expedition against Greece -	481
Ezra restores Jerusalem, seventy weeks of years, or 490 years before the death of our Saviour - -	458
The history of the old Testament closes about -	430
Obliquity of the Ecliptic observed to be 23° 49′ 10″	359
Alexander the great born - - -	356
Sun-dial first erected in Rome - - -	293
Dionysius of Alexandria began his era, being the first who ascertained the solar year to consist of 365 days, 5 hours, and 49 minutes - - -	285
The first Punic war began - - -	264
Obliquity of the Ecliptic observed to be 23° 51′ 20″	230
Annibal invades Italy over the Alps - -	218
Paper invented in China - - -	170
The first library formed in Rome - -	168
Hipparchus began his astronomical observations -	162
Corinth and Carthage destroyed by the Romans -	146
History of the Apocrypha ends - - -	135
Julius Cæsar's first descent in Britain - -	55
Cæsar defeats Pompey at Pharsalus - -	48
Celebrated library at Alexandria accidentally burnt -	48
Cæsar murthered by Brutus and other conspirators	44
The *Saviour of the World* born - - -	5

	Year after the Christian era.
The common Christain era as settled by Dionysius began on the 1st January, Christ being then 5 years old -	1
Jesus Christ baptized by John - - -	29
He suffers at Jerusalem in the 38th year of his age	33
Claudius Cæsar's expedition to Britain - -	43
London became a Roman station - -	50

Christianity

	After Christian Era.
Christianity said to be introduced into Britain	60
Jerusalem taken and utterly destroyed by Vespasian and Titus	70
Pompeia and Herculaneum overwhelmed by an eruption of Vesuvius. Pliny the elder dies	79
Agricola builds his wall between the Forth and the Clyde	85
Adrian builds a wall between Newcastle and Carlisle	121
Silk first brought from India	274
Wines first made in Britain	276
The Franks, a German nation, settle in Gaul, which from them was called France	277
Observation of Sunday enjoined under Constantine the first Christian emperor of Rome	321
Constantine removes the seat of empire from Rome to Byzantium, thence called Constantinople	328
Roman empire divided into eastern and western	364
Europe overrun by the Goths under Alaric	401
France formed into a kingdom under Pharamond	420
City of Venice founded	452
The Mahometan era of the Hegira or flight of Mahomet from Mecca begins	622
England invaded by the Danes	653
Glass first brought to England	663
The Britons subdued by the Saxons	685
Computations from the birth of Christ used in history	748
Charlemagne founds the western empire	800
Obliquity of the Ecliptic observed to be 23° 55′	825
Ditto 23° 35′	880
Ditto 23° 33′ 30″	911
Juries instituted in England	979
Arithmetical cyphers brought into Europe by the Saracens: letters of the alphabet had hitherto been used	991
Paper made of cotton rags in use	1000
The Danes finally driven out of Scotland	1040

The

	After Christian Æra.
The conquest of England by William Duke of Normandy - - - - -	1066
The tower of London built by him - -	1080
First crusade for the recovery of the holy land -	1096
Henry 2d of England gains possession of Ireland -	1172
Glass windows in private houses in England -	1180
A conjunction of all the planets at sunrise 16th Sept.	1186
Magna Charta signed by King John - -	1215
Astronomy and geography revived by the Moors of Spain	1223
Commons of England first summoned to parliament	1264
Parliament regularly held from this year being the 22d of Edward the 1st - - - -	1293
Turkish empire founded by Ottoman - -	1298
Mariner's compass improved by Gioia of Amalfi -	1302
Gunpowder made by a monk at Cologne - -	1330
Gold first coined in England by Edward 3d -	1344
Edward the 3d had 4 pieces of cannon at Cressy -	1345
Coals first brought to London - - -	1357
Wickliffe the English reformer flourished -	1369
Canary Islands discovered by a Norman - -	1405
Painting in oil invented at Bruges by John Van Eyck	1410
Algebra introduced into Europe - -	1412
Obliquity of the Ecliptic observed to be 23° 30′ 17″	1427
Printing invented by Laurence of Haerlem who died in	1440
Constantinople taken by the Turks; Greek empire ends	1453
Glass manufactured in England - -	1457
Engraving and etching on copper invented about -	1460
Printing brought to England by Caxton - -	1471
America discovered by Colon or Columbus -	1492
Portuguese sail to India round the Cape of Good Hope	1497
Shillings first coined in England - -	1505
Obliquity of the Ecliptic observed to be 23° 28′ 30″	1510
Martin Luther began the Reformation - -	1517
First voyage round the world by Magellan's ships -	1522

Reformation

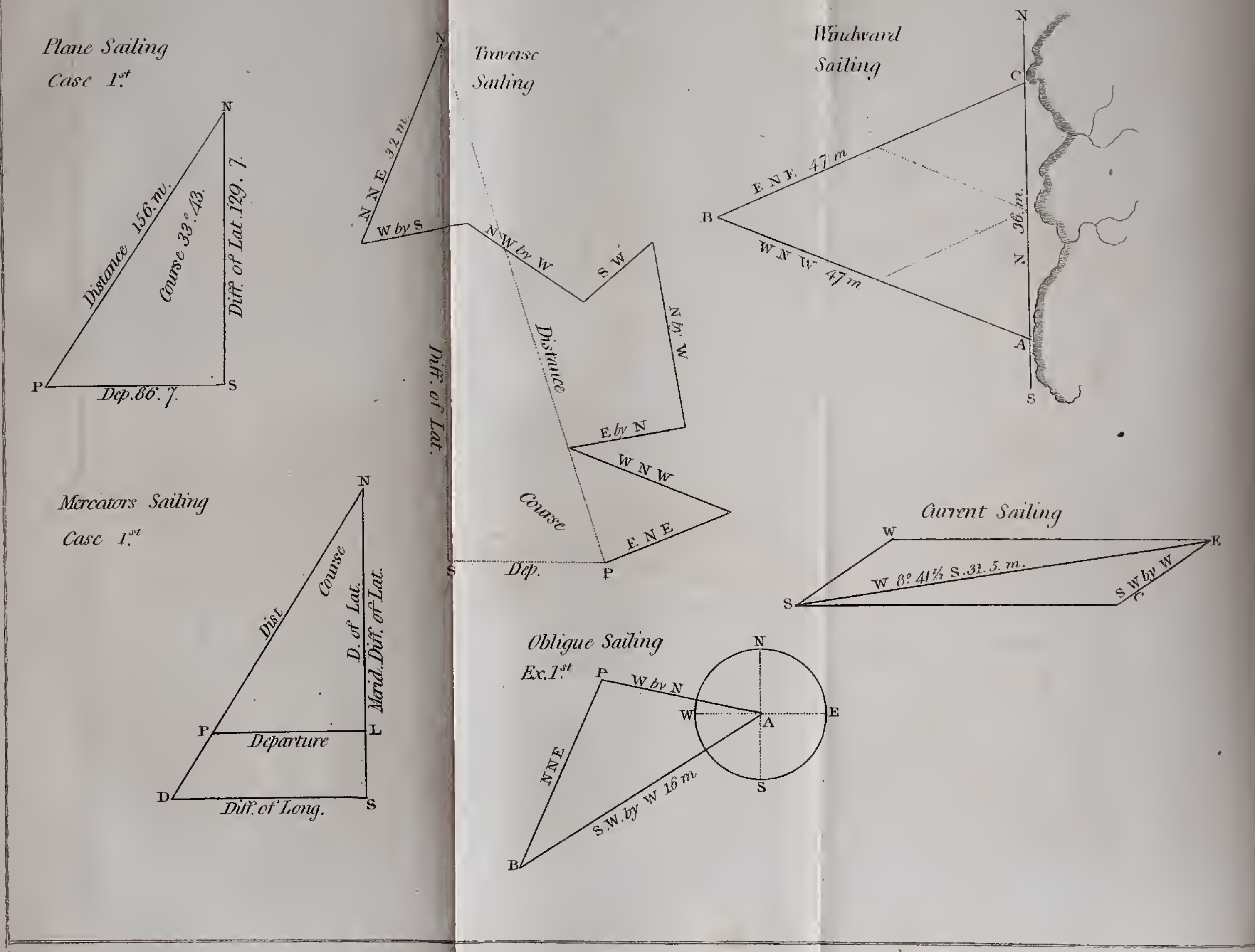
	After Christian Æra.
Reformation introduced into England - -	1534
Variation of the compass discovered by Cabot -	1540
Obliquity of ecliptic observed by Copernicus 23° 28′ 8″	1540
Reformation completed in Scotland by John Knox	1560
Pope Gregory reforms the calendar - -	1582
Tobacco first brought to England from Virginia -	1583
Mary queen of Scotland beheaded by Elizabeth -	1587
Telescopes invented in Germany - -	1590
Decimal arithmetic invented at Bruges - -	1602
Union of the crowns of England and Scotland -	1603
Galileo of Florence discovers Jupiter's Satellites -	1610
Thermometers invented by Drebel in Holland -	1610
Logarithms invented by Napier in Scotland -	1614
Circulation of the blood, established by Harvey: this had been suggested in France in 1553 - -	1619
Barbadoes the first British settlement - -	1625
Barometers invented in Italy by Torricelli -	1643
Pendulums applied to clocks by Huygens - -	1649
Air-pump invented by Guericke of Magdeburg -	1653
Restoration of Charles 2d on the 29th May -	1660
Royal Society of London established - -	1662
Tea first used in England - - -	1666
Newtonian philosophy published - -	1686
Revolution began on the 5th November - -	1688
Land-tax enacted in England - - -	1689
Obliquity of ecliptic observed to be 23° 28′ 32″ -	1691
Bayonets first used by the French - - -	1693
Bank of England established - - -	1693
Union of the kingdoms of England and Scotland	1706
New style introduced into Britain - -	1752
Society for encouragement of arts, manufactures, &c. established in London - - -	1753
Transit of Venus over the Sun, 6th June - -	1761
Cook returns from his first voyage round the world	1771

 United

	After Christian Era.
United States of N. America declare themselves independent - - - -	1776
Dr. Herschel discovers the planet called by his name	1781
———————— two of its satellites -	1787
Revolution in France began - - -	1789
King of France deposed - - -	1792
United parliament of Britain and Ireland met for the first time on the 22d January - - -	1801
Peace between Britain and France signed 22d March	1802

THE

NAVIGATION.


Plane Sailing
Case 1st
Distance 156.m.
Course 33°.43.
Diff. of Lat. 129. 7.
Dep. 86. 7.
Traverse Sailing
N N E 32 m.
W by S
N W by W
S W
N by W
E by N
W N W
E. N E
Distance
Course
Diff. of Lat.
Dep.
Windward Sailing
E N E 47 m
W N W 47 m
N. 36. m.
Mercators Sailing
Case 1st
Dist.
Course
D. of Lat.
Merid. Diff. of Lat.
Departure
Diff. of Long.
Current Sailing
W 8° 41½ S. 31. 5. m.
S W by W
Oblique Sailing
Ex. 1st
W by N
N N E
S.W. by W 16 m

THE MODERN PRECEPTOR.

CHAPTER IX.

NAVIGATION.

NAVIGATION is the art of conducting a ship from one port to another across the ocean, and of ascertaining her position at any given point of her course.

In navigation two things are supposed to be given, the direction in which the ship sails or her course, and the distance she runs over in that direction. The direction or course is ascertained by means of an instrument, called from its usefulness to seamen, the *mariner's compass*, consisting of a circle of strong paper or card, having its circumference divided into 32 equal parts, each division being termed a point of the compass; and as the circumference of every circle is divided into 360 degrees (vol. i. p. 383), the interval between any two points must be the 32d part of that circumference, or 11 deg. 15 min.

When in any part of the northern hemisphere, we turn our face towards the sun on the meridian, or at noon, he is then due south from us, and the pole star immediately opposite, behind us, is due north; our left hand is turned to the east, and our right to the west. The horizon is therefore

 divided

divided into 4 equal parts or quadrants, each containing 90°, by radii drawn from the place where we stand to the north, south, east, and west points. If we divide the quadrant formed by the radius pointing north and that running east into two equal parts, we obtain a point partaking equally of these two directions, and therefore styled north-east: again bisecting the arch between N and NE we have the NNE point, and bisecting the arch between NE and E we have the point ENE. If between N and NNE we assume another equidistant division, it is called N by E, while the intermediate point between NNE and NE is called NE by N: the point midway between NE and ENE is on the other hand termed NE by E, while that equidistant between ENE and E is styled E by N. In this manner each quadrant of the compass and of the horizon is divided into eight points, and the whole circumference consequently into thirty-two, which begininning at N and running round by W S and E, are named as in the following table:

North-west Quadrant.	*South-west Quadrant.*	*South-east Quadrant.*	*North east Quadrant.*
N. by W.	W. by S.	S. by E.	E. by N.
N. N. W.	W. S. W.	S. S. E.	E. N. E.
N. W. by N.	S. W. by W.	S. E. by S.	N. E. by E.
N. W.	S. W.	S. E.	N. E.
N. W. by W.	S. W. by S.	S. E. by E.	N. E. by N.
W. N. W.	S. S. W.	E. S. E.	N. N. E.
W. by N.	S. by W.	E. by S.	N. by E.
WEST.	SOUTH.	EAST.	NORTH.

The points are subdivided into halves, quarters, and eighths *. The circumference of some compasses is also divided

* Every thing ought to be carefully avoided which may in any way tend to mislead the navigator: it is proper therefore to observe that certain nations of

divided into degrees, minutes, &c. for determining the direction of the ship's course with greater accuracy; because this course may not exactly coincide with any point or even eighth part of a point, and the bearing is expressed thus, N. 35° 17′ E. S. 73° 29′ W.

To the lower side of the compass card is fixed what is called the needle, which ought to be a straight bar of hard steel, with square ends: this needle being rendered magnetic, and nicely balanced on the top of a slender pin so as to move freely round this central point, will place itself in the direction of the meridian, one end pointing to the N. and the other to the S. This magnetic meridian, however, coincides with the true meridian of the earth only in very few places: the angle of deviation is termed the variation of the needle; and this variation itself is not fixed at any one place, but undergoes a gradual change. When the needle points in a direction to the eastward of the true north, the variation is said to be easterly, and westerly when it points to the westward of north. The following table contains a statement of the variation (or declination from the true meridian) of the magnetic needle at London in different years, by which it appears that 230 years ago the needle pointed considerably to the eastward of N.; that 150 years ago it pointed due N.; and that a few years ago, it pointed 24° or upwards of two points to the westward of N.

of Europe, viz. the French, the Portuguese, the Spaniards, and the Italians, have a peculiar mode of denominating the divisions of the compass, in which the expressions *un quart*, *un quarto*, signifying not *a quarter of a point* in the English sense, but *a whole point itself*, as being the quarter of the space containing 4 points comprehended between any of the cardinal points, N. W. S. and E. and the intermediate points NW, SW, SE, NE. In this way N¼ E. in a Spanish work on navigation means in English N. by E.; SW¼W, represents our SW. by W. &c.

Years.

Years	Variation.	Years.	Variation	Years.	Variation.
	Easterly.		Westerly.		Westerly.
1576	11° 15	1672	2° 30	1773	21 9′
1580	11 11	1683	4 30	1775	21 30
1612	6 10	1692	6 0	1780	22 10
1622	6 0	1700	8 0	1785	22 50
1633	4 6	1717	10 42	1787	23 19
1634	4 5	1723	14 17	1790	23 34
1656	0 0	1748	17 40	1795	23 57
	Westerly.	1760	19 12	1800	24 7
1665	1 2½	1765	20 0	1802	24 6
1666	1 35	1770	20 35	1805	24 8

Besides the variation or declination of the magnetic needle from the direction of the earth's axis, it is subject to another irregularity, by which in the northern hemisphere that end pointing to the north is drawn a little downwards from the horizontal line, and the reverse in the southern: this is called the *dip* of the needle. At the equator the needle being equally acted upon by both poles of the earth, maintains a horizontal position; but if it be moved towards either pole, the end next to the pole towards which it is removed will gradually dip more and more below the horizontal line; and would probably, if it could be carried quite to the pole, there stand perpendicular to the surface of the earth. At London in the year 1786, the north end of the magnetic needle dipped 17° 52′ below the horizon, and in 1805, the dip was found to be 19° 39′.

The instruments usually employed to ascertain the distance run in a given time by a ship at sea, are the *log*, and the *half-minute glass*. The log is commonly a thin piece of timber, shaped like the quadrant of a circle of 5 or 6 inches radius, having a plate of lead attached to the circular part, so as to make the log swim perpendicularly in the water. To this piece of timber is fastened a small cord or line from 100 to 150 fathoms in length, divided into equal

parts

parts by pieces of twine, with as many knots on them as there are spaces between each, and the first mark from the log: from this the distances themselves are called *knots*, and they ought to bear the same proportion to the nautical mile that half a minute bears to an hour, or the knots ought to be $\frac{1}{120}$ of a nautical mile, which being equal to a minute of a degree of a great circle on the earth, or to 6,100 English feet, each knot should contain nearly 51 feet: as a precaution however against mistakes and accidents, it is customary to make the distance between any two knots only from 48 to 50 feet. The glass employed at sea is a small sand-glass of the ordinary construction, but containing only so much sand as will run from the one end to the other in half a minute. When the log is thrown from the ship into the water, the number of spaces or knots on the line run out while the glass runs half a minute is observed; and on the supposition that the ship's motion for a certain time, as an hour, is tolerably equable, it is ascertained by the following proportion: as the half minute run by the glass to the number of knots shown by the log, so is one hour to the number of miles sailed in that time.

In king's ships and East Indiamen it is usual to heave the log every hour, but in other vessels once in every two hours is considered to be sufficient: but with every precaution and allowance that can be applied, this mode of measuring a ship's rate of motion, notwithstanding the many improvements suggested by ingenuity and experience, must be subject to great uncertainty, from the unequal force of the winds during even the short space of an hour, from the motion of the water by currents and waves, and from other contingencies which do not admit of any accurate computation.

Were it possible at sea to determine a ship's position by celestial observation with sufficient accuracy, much of the uncertainty of the ordinary method of measuring her course

and

and distance would be removed; but certain nice astronomical operations requisite for that purpose are found to be impracticable on board, from the motion of the vessel, and for which no sufficient remedy has yet been discovered.

In the Introduction to Geography, (vol. ii. pp. 9 and 10.) the nature and manner of computing the latitude and longitude of any place on the earth's surface were explained. The elevation of the north pole star above the horizon of any place on the northern hemisphere, being constantly equal to the latitude of that place, a correct measurement of this angular elevation would at all times indicate the latitude of the place of observation. A similar operation respecting the altitude of the south pole would in the southern hemisphere answer the same purpose. The usual way, however, of determining the latitude at sea, is by an observation of the sun's altitude above the horizon when on the meridian, or by two or more altitudes at determined intervals, when he is out of the meridian: the first method, when from clear weather or other favourable circumstances it is practicable, is always to be preferred.

Various instruments have been employed to measure the sun's altitude: but that which is now justly preferred to all others is *Hadley's quadrant*, by which through the adoption of certain optical principles, observations of the altitudes and relative distances of the heavenly bodies may be performed on ship-board with the greatest accuracy. The name *quadrant* expresses the fourth part of a circle or 90 degrees; this instrument however is only half of a quadrant, the circular part containing 45 degrees; but by means of the double reflection of the ray of light from the body observed, the same effect is produced as if the instrument comprehended double its arc. The index moving round the central point of the instrument, points out on the graduated limb or arch the quantity of the angle of elevation of the body observed.

Although

Although in fact the sun be fixed in the center of our system, and the earth be moveable round him, yet in common language, the reverse is usually admitted; when therefore the earth is, for example, in the tropic of Capricorn, we say the sun is in that of Cancer, and *vice versa*. Hence it is that we speak of the sun's place, of his motion, of his declination or distance from the celestial equator, and other particulars relatively applied to him, but in fact belonging to the earth alone.

As the visible hemisphere at any place on the globe may be considered to comprehend an arch from the horizon on the north, to an opposite point on the south of 180 degrees, and that the arch intercepted between the north pole and equator is always a quadrant or 90°, it follows that the elevation of the pole above the horizon, and that of the equator above the opposite horizon, must together be equal to another quadrant or 90°. If then we can determine the elevation of the equator or of any body in it above the horizon, by subtracting this quantity from 90°, we obtain the elevation of the pole, which is always equal to the latitude of the place.

The sun being in the equator in all parts of the world on the days of the vernal and autumnal equinoxes, or about the 21st of March, and the 22d of September, let his meridian altitude be correctly observed at London to be 38° 29′; this quantity taken from 180°, will leave the arch between the sun's body and the northern extremity of the meridian, or 141° 29′: but the arch between the equator and the pole being always 90°, we may at once subtract the altitude 38° 29′, from another quadrant or 90°, and the remainder 51° 31′, will be the elevation of the pole above the northern horizon, which as was before said is always equal to the latitude of the place of observation. By this simple operation therefore we find London situated in 51° 31′ of N. latitude.

Again,

Again, if upon the 21st of June, when the sun is at the summer solstice in the tropic of Cancer, his meridian altitude at London be observed 61° 57′, we first bring him back to the equator by deducting from his altitude the arch of the meridian, intercepted between the equator and the tropic, or in other words by deducting the sun's declination for that day, equal to the angle of inclination formed by the ecliptic with the equator, which is 23° 28′. This sum taken from 61° 57′, the observed altitude will leave 38° 29′, for the arch of the meridian between the southern horizon and the equator; which again subtracted from a quadrant or 90°, will give 51° 31′, for the elevation of the pole and the latitude of London, the place of observation, as in the former example.

In the same way the latitude may be discovered by means of the sun's meridian altitude on any intermediate day, between the vernal and autumnal equinoxes, or while he is on the north side of the equator, as for example on the 12th of August, 1808, when his meridian altitude at London was observed to be 53° 28; the sun's declination being on that day 14° 59′ N. If from the observed altitude 53° 28′, we subtract this declination, we bring down the sun to the equator, which therefore is elevated 38° 29′, above the horizon at London, and the complement of this quantity to 90°, or 51° 31′, is the latitude of London, as required.

On the other hand, from the autumnal to the vernal equinox, or while the sun is on the south side of the equator, his declination is to be added to the observed meridian altitude, and the sum, equal to the elevation of the equator above the southern horizon, subtracted from 90°, will give the latitude of the place of observation. Thus at London on the 22d of November, 1808, the sun's altitude at noon was observed to be 18° 18′, when his declination was 20° 11′, S.: these two quantities added together give 38° 29′, for the elevation of the equator, and its complement to 90°, or

or 51°, 31′, is the latitude of London required. Again, if on the day of the winter solstice when the sun is in the tropic of Capricorn, on the 22d of December, 1808, the sun's meridian altitude at London were found to be 15°, 1′; by adding this quantity to the sun's declination on that day 23° 28′, we obtain 38° 29′, for the elevation of the equator, the complement of which to 90°, or 51° 31′, is the latitude of London, as found in all the preceding examples.

It is a general axiom that half the *sum* of the meridian altitudes of the sun, as observed at any given place, on the longest and shortest days of the year, or at the summer and winter solstices, is constantly equal to the complement of the latitude of the place of observation; and that half the *difference* between the same altitudes is equal to the angle of inclination between the ecliptic and the equator.

In making observations of the altitudes and relative distances of the celestial bodies, certain allowances or corrections are to be made, in order to obtain their true position: these corrections regard the apparent diameter and parallax of the body observed, and the error in its true place occasioned by the dip or the elevation of the eye above the horizon, and by the refraction of the rays of light passing through the atmosphere from the observed body to the eye: the two first corrections, however, are not required in observing the position of a fixed star. The apparent diameter of the sun, as seen from the earth, varies according to her place in her orbit, or to his distance; in the end of December, when she is nearest the sun, his diameter subtends an angle of 32′, 36″, and in the end of June, when the earth is farthest from the sun, his apparent diameter is 31′ 18′: the mean of these two quantities or 31′ 57″ may therefore be taken as the average apparent diameter of the sun for the whole year; and consequently his semidiameter will be nearly 15′ 59″, or in round numbers 16 minutes. The apparent diameter

 of

of the moon is subject to still greater variation than that of the sun, for when smallest it subtends an angle of 29½ minutes, and when greatest an angle of 34 minutes. If therefore the altitude of the lower limb or edge of the body of the sun or moon be measured, by adding to the observed quantity, the semidiameter of each body respectively, we obtain the altitude of its centre; and if the upper limb or edge be observed, by subtracting from its altitude the semidiameter, the remainder is the elevation of the center.

If we could penetrate to the center of the earth, and thence take a view of the surrounding bodies of the universe, each would appear in its due position with respect to the others, or in its *true* place: but as this is impossible, we from the surface must see the sun, moon, &c. in its *apparent* place, a situation somewhat different. This difference or parallax is too minute in the case of the sun to be observable; but the moon's parallax when greatest, that is when she is in the horizon, amounts to 57 18″, or nearly to one degree, and it will gradually diminish, until she come to be vertical to the observer, when the line from the center of the earth to the moon must pass through the place of observation, when all parallax must vanish: this however can happen only in regions in the vicinity of the earth's equinoctial line.

Were the eye of an observer to be placed on the surface of the earth, the natural horizon would coincide with his line of sight; but if the eye be elevated above the surface, the line of sight or tangent to the surface drawn through the eye will no longer fall in with the horizon at the place of observation, but will cross it, forming an angle of depression increased in magnitude as the eye rises above the surface of the globe: this angle is termed the dip of the horizon. The consequence of this is that the altitudes of the heavenly bodies observed even by a person in a boat on the water, must always come out a little greater than the truth, (see vol. i. p. 336, &c. and vol. ii. p. 3, &c.)

The

The following table contains in round numbers the angle of depression of the sensible below the true horizon, for various heights of the eye above the latter, from one foot to one hundred feet.

Height of the Eye.	*Dip or angle of Depress.*	*Height of the Eye.*	*Dip or angle of Depress.*
Feet.	*Minutes.*	*Feet.*	*Minutes.*
1	1′.0	21	4′.4
2	1.4	22	4.5
3	1.7	23	4.6
4	1.9	24	4.7
5	2.1	25	4.8
6	2.3	26	4.9
7	2.4	28	5.0
8	2.7	30	5.2
9	2.9	35	5.6
10	3.0	40	6.0
11	3.2	45	6.4
12	3.3	50	6.7
13	3.4	55	7.1
14	3.6	60	7.4
15	3.7	65	7.7
16	3.8	70	8.0
17	4.0	75	8.2
18	4.1	80	8.5
19	4.2	90	9.0
20	4.3	100	9.5

The number of minutes in the table opposite to any given elevation of the eye above the true horizon, is always to be deducted from the observed altitude of any object: thus if the altitude of the sun's center were found to be 56° 10′, by an observer on board ship whose eye was elevated 25 feet above the surface of the sea, the correction in the table corresponding to 25 feet, or 4 minutes and 8 tenths must be deducted, leaving 56° 5′.2 for the true altitude of the object observed.

As a ray of light in passing from any medium into another

of

of a different density is bent downwards or refracted, we come to observe an object seemingly raised up to our view, which if the intervening medium were all of the same density would be invisible. Thus if a shilling be placed in an empty bason, so that it shall be hidden from an observer's eye by the edge of the vessel, and water be slowly poured into the bason, the shilling will gradually begin to appear as if floated up by the water, and at last be entirely discovered; again if a straight cane or stick be placed in water in an inclined direction, it will appear to be bent upwards at the surface of the water, the lower extremity being refracted considerably above its true position. In the same way a ray of light proceeding from any celestial body is refracted in passing through our atmosphere, occasioning the body to be visible to us before it ought in fact to come within our view; and this refraction is the greater in proportion to the density of the atmosphere; hence the sun becomes visible at a sensible distance before he is truly risen upon the horizon; hence also he remains some time visible above the horizon when he is in fact below it; and hence the higher any body rises above the horizon, the less is the effect of refraction on the rays proceeding from it, and when it becomes vestical no refraction takes place.

The following table shows the allowance to be made for refraction in observing the altitude of any celestial body, according to the mean state of the atmosphere in Britain, when the Mercury stands at 29½ inches in the barometer, and Fahrenheit's thermomcter indicates a temperature of 50°. The first column contains the angular elevation of the object observed, and the second the corresponding quantity of refraction, which must be added to the observed height of the object, in order to obtain the true altitude. The table shows that a body, by the refraction of the light appears already 33 minutes above the horizon, when it is in fact only beginning to touch it, or when it has no elevation, and that

that the refraction progressively diminishes until the body arrives in the zenith or at an elevation of 90°, when it vanishes.

Alt. ° '	*Refract.* ' ''	*Alt.* ° '	*Refract.* ' ''	*Alt.* ° ''	*Refract* '
0. 0	33 00	7.00	7.20	21.00	2.27
0 10	31.22	7.15	7.06	21.30	2.24
0.20	29.50	7.30	6 53	22.00	2.20
0.30	28 23	7.45	6.41	22.30	2.17
0.40	27.00	8.00	6 29	23.00	2.14
0 50	25.42	8.20	6 15	23.30	2.11
1.00	24.29	8.40	6 01	24 00	2.08
1.10	23 20	9.00	5 48	24.30	2 05
1.20	22.15	9.20	5.36	25 00	2 02
1.30	21.15	9 40	5.25	26.00	1.56
1.40	20.18	10.00	5.15	27.00	1.51
1.50	19 25	10.20	4.05	28.00	1.47
2.00	18 35	10.40	4.56	29.00	1.12
2.10	17.48	11.00	4.47	30 00	1.38
2.20	17.04	11 20	4 39	31.00	1.35
2.30	16.24	11.40	4.31	32.00	1.31
2.40	15 45	12.00	4.23	33.00	1.28
2.50	15.09	12.30	4.13	34.00	1.24
3.00	14.36	13.00	4.03	35.00	1.21
3.15	13.49	13.30	3.54	36.00	1.18
3 30	13.06	14.00	3.45	37 00	1.16
3.45	12.27	14 30	3.38	38 00	1.13
4.00	11.51	15.00	3.30	39 00	1.10
4.15	11.18	15.30	3.24	40.00	1.08
4.30	10 48	16.00	3.17	42 00	1.03
4.45	10.20	16 30	3.10	44.00	0 59
5.00	9.54	17 00	3.04	46.00	0.55
5.15	9.30	17 30	2 59	48.00	0.51
5.30	9.08	18.00	2 54	50.00	0.48
5.45	8.47	18 30	2 49	55.00	0 4[illegible]
6.00	8.28	19 00	2.44	60 00	0 33
6.15	8.09	19.30	2.40	70.00	0.21
6.30	7.51	20.00	2.35	80.00	0.10
6.45	7.35	20.30	2.31	90.00	0.00

By the following example the manner of employing the preceding allowances or corrections will be shown. At Dover, situated in N. latitude, on the 12th of August, 1808, the

the meridian elevation of the lower edge or limbe of the sun's body, was found to be 53° 40 ½, by an observer whose eye was raised 16 feet above the horizon; the latitude of the place of observation is hence to be deduced.

Observed alt. of sun's *lower* limbe -		53°. 40′ 30″
Add his semidiameter - -		16. 00
Observed alt. of sun's center -		53. 56. 30
Refraction for that altitude	0′. 42″	
Dip of horizon for 16 feet the elevation of the observer's eye - .	3. 48	
Sum to be subtracted - -		0. 4. 30
Corrected alt. of sun's center -		53. 52. 0
Compt to 90°, or the zenith distance,		N 36. 8. 0
Sun's declination 12th Augt. 1808.		N 14. 59. 0
Corrected latitude of Dover -		N 51. 07. 0

By adding the sun's semidiameter 16′ to the observed altitude of his lower limbe, we have the observed altitude of his center (had the upper limbe been observed, this semidiameter must have been subtracted), and from this quantity we take away the amount of the effect of the refraction of the atmosphere on an object at such an elevation, which raises it 42″ above its true place, and also of the dip or depression of the horizon corresponding to the height of the observer's eye above the true horizon or 3′ 48″, the apparent horizon being so much depressed below the true; the remainder in this operation 53° 52′, is the true corrected altitude of the sun's center, which taken from a quadrant or 90° leaves 36° 8′ for the distance between the sun and the zenith of the place of observation; and to this quantity adding

adding the sun's declination on the given day (from the tables calculated and published for this purpose) we obtain 51° 7′, for the latitude of Dover as required.

Again let the meridian altitude of the sun's upper limbe, be observed on the 10th February, 1809, to be 38° 40′, by an observer whose eye was raised 12 feet above the horizon; required the position of the place of observation which was in N. latitude.

Observed alt. of sun's *upper* limbe -		38°. 40′. 00″
Subtract his semidiameter - -		16. 0
Observed alt. of sun's center -		38. 24. 0
Refraction at this alt.	1′. 10″	
Dip for 12 feet -	3. 3	
Sum to be subtracted - -		0. 24. 13
Corrected alt. of sun's center -		38. 19. 47
Compt. to 90°, or zenith distance -		N 51. 40. 13
Subtract sun's declin. 10th of Feby. 1809		S 14. 23. 0
Lat. of place of observation -		N 37. 17. 13

The latitude of a place may in a similar manner be found from the observed meridian altitude of a star or a planet, only that in such cases no allowance for semidiameter is required, and that the error occasioned by the parallax, of even the nearest planet to us, is so small that it may safely be disregarded in the calculation.

In determining the latitude of any place by observations of the meridian altitude of the moon, besides the corrections for apparent semidiameter, dip of the horizon, and refraction, others must be taken into account occasioned by the many irregularities of her motion, of which tables are calculated, and inserted in the *Nautical Almanack*, published annually under

under the authority of the Board established for ascertaining the best method of determining the longitude at sea.

The latitude may also be discovered by observing equal altitudes of the sun on one day, and accurately measuring the time elapsing between the observations; as also by observing any two altitudes of the sun in one day, and the interval of time between them, when the declination and the supposed latitude are known. These methods however, are in themselves too intricate for a short popular explanation, and they require the use of a number of tables usually published in treatises on navigation, but which neither the objects nor the limits of this work can admit.

Supposing the position of a ship with respect to latitude to be accurately determined, her place on the globe will still be very vaguely known, without in the same way ascertaining her longitude with regard to some established first meridian. Various methods of solving this important problem have been devised: as early as in the end of the 16th century, Philip the 3d of Spain offered a reward for its solution; his example was soon followed by the states of Holland: and in 1714 the British parliament established commissioners for the same purpose, with rewards to be granted according to the degree of accuracy in ascertaining the longitude to be obtained by each proposed method.

The circumference of the earth's equator being 360° if a person could encompass it in 24 hours, he would move at the rate of 15° in every hour: or the earth performing its diurnal rotation in the same time 24 hours, if the sun be on the meridian of any given place at a certain time, he will be an hour later in coming on the meridian of another place 15° to the westward of the former, and he will have been an hour sooner on the meridian of a place 15° to the eastward of the first. If therefore a method were devised of accurately measuring time, we could compare the current time at the place

place of observation, with that at the place fixed on for the first meridian; and by the standing proportion of allowing 15 degrees of longitude for 1 hour of time, we could correctly ascertain the longitude of the place of observation: thus, if a watch or other machine were contrived to indicate time with accuracy, and were set to the true time at Greenwich Observatory, which is now considered as the first meridian by British navigators and astronomers; and if this watch by a regular equable motion should, on being carried to Barbadoes, point out the time at Greenwich to be 3 hours, 58 minutes, 46 seconds after noon; while in the island the sun was just come to the meridian; by multiplying the above difference of time by 15, the product 59° 41′, is the longitude of Barbadoes W. from the meridian of Greenwich.

Again, if an observer on a voyage up the Mediterranean, with a watch regulated by the time at Greenwich, should on his arrival at Gibraltar find, when his watch pointed exactly to noon, that the current time there was only 11 hours, 38 min. 20 sec. before noon; and also that when he landed at Malta it was there reckoned 57 minutes, 52 seconds, after 12 o'clock, when his time-keeper stood at 12; computing at the rate of 15° of long. for every hour of time, he would find the difference of longitude between Greenwich and Gibraltar to be 5° 20′ *westerly*, because the apparent time there was *behind* that at Greenwich, and on the other hand that the difference of longitude between Greenwich and Malta was 14° 28′ *easterly*, because the apparent time in that island was *before* that at Greenwich.

Induced by the simplicity of this theory many ingenious artists have laboured assiduously to contrive a watch or time-keeper which should preserve a regular equable rate of motion at all times, in all countries, and under every variation of temperature: and indeed so nearly have such machines of late years been brought to perfection, that

 little

little hope can be entertained of their ever being very materially improved: but the person who made the greatest advances in the mechanism of the time-keeper, was the late Mr. John Harrison of London, on whose principles one was constructed by Mr. Kendal, which was carried by Captain Cook in his voyage round the World in 1772, 1773, 1774, and 1775, and in all that time never erred quite $14\frac{1}{2}$ seconds in any one day: on which account parliament granted to Mr. Harrison the full reward of £20,000. A watch has since been constructed by Mr. Arnold, also of London, which during a trial on shore of 13 months never varied more than about $6\frac{2}{3}$ seconds during any two days. Great improvements in the construction of time-keepers, marine-watches, chronometers, (for by all these names they are known), have also been made at Paris by Messrs. Le Roy, Berthoud, &c. Still however as these machines from the very nature of their structure, and of the component materials, must be liable to accidents, and may by unknown causes become erroneous, varying their rate of motion insensibly and without any possibility of detecting their variation, some method is indispensable to enable the navigator to prove the accuracy of his chronometor, and to ascertain and correct the error it may have contracted. For this purpose recourse must be had to celestial observation, and the moon's position with respect to the fixed stars, the begining and end of eclipses, &c. have been proposed; but as it is necessary some sensible change in these appearances should take place in a very short interval of time, for an error of only one minute of time would occasion a difference of 15 minutes of longitude, the most convenient object for celestial observation are the satellites of Jupiter, (Astronomy, vol. ii. p. 219), which from their number and the comparatively short periods of their revolutions round his body present a rapid succession of eclipses or approximations with one another. Of the various appearances of these satellites

satellites tables have been computed and published, calculated in this country for the meridian of Greenwich, so that by comparing the period of an eclipse or any other phenomenon of these bodies, as observed at any distant place, with the time in the tables when the same appearances are observable at Greenwich, the difference between the two meridians or the difference of longitude will be readily ascertained. Unfortunately however for the mariner the operations requisite for observing the eclipses of Jupiter's satellites are, from the constant motion of a ship at sea, next to impracticable, nor has any method of surmounting the difficulty yet been discovered. The attention of astronomers and navigators has therefore been of late drawn to the best mode of measuring the angular apparent distance between the sun and the moon, or between the moon and some remarkable star near her path: and for this purpose the Nautical Almanacks contain every calculation requisite for assisting in the solution of this very nice problem. The instruments required for this operation are a good watch, which can be depended on for keeping time within the error of a minute for six hours together, and a quadrant of Hadley's construction, or rather a sextant, the limbe being one-sixth part of a circle containing 60°, but on account of the double reflection comprehending in fact 120°, fitted up with a small telescope the more accurately to ascertain the instant of the moon's contact with any given star. The precise moment of this contact being ascertained, and the altitudes of both bodies being at the same time carefully measured by assistants, the materials are obtained for determining the longitude of the place of observation; for comparing the difference in time between the contact of the two bodies as observed at the ship and as stated in the Nautical Almanack for the meridian of Greenwich, and converting that difference into degrees and minutes of the equator, the longitude of the ship will be ascertained.

As

As the state of the atmosphere will not at all times allow the proper operations to be performed, for determining the latitude and longitude by celestial observation; and as it is the indispensable duty of the navigator to avail himself of every method of ascertaining his position during his voyage, various modes of calculating a ship's place have been adopted, such as *Plane sailing*, *Traverse sailing*, *Parallel sailing*, *Middle latitude sailing*, *Mercator's sailing*, *Oblique sailing*, *Windward sailing*, *Current sailing*; all of which are useful according to the circumstance of the voyage.

Plane Sailing.

In this method of navigation, the earth is supposed to be not a globe but one vast extended plane, in which the meridians instead of centring at the poles lie parallel to each other and every where equidistant, and where consequently the degrees of longitude are, at all distances from the equator, of equal extent on the surface of the earth. This supposition, it is true, is entirely contrary to fact: but in short courses and in latitudes adjoining to or not far removed from the equator, the errors occasioned by such a supposition are not of great importance.

In Plane sailing the things given or required are the *Course* or point of the compass on which the ship sails, the *Distance* run on that course in a given time, the *Difference in latitude* between the ship's place at the beginning and at the end of the course, and the *Departure* or distance between the meridian of the place sailed from and that of the place come to: the difference of latitude is also called the *Southing*, and *Northing*, and the departure is called the *Easting*, and *Westing*.

Case 1st.—*Given the course and distance, to find the difference of latitude and the departure.*

If a vessel sail from Cape St. Vincent in Portugal, situated

situated in N. lat. 37° 3′, 156 nautical or geographical miles, in a direction 3 points to the westward of south, that is south-west by south, what is her latitude at the end of the course, and how much has she departed from the meridian of the cape?

Let an indefinite line be drawn on paper N and S, to represent the meridian passing through Cape St. Vincent: choose any point in the northern part of this line for the position of the cape or of the ship considered as at it, and describing round that point a circle (or so much only as may be requisite), set off upon this arch from the southern part of the meridian, and on the left hand or western side, the number of degrees and minutes corresponding to the angle of the course SW by S or 3 points, which at 11° 15′ will be equal to 33° 45′, and through this intersection drawing another indefinite line from the point representing the cape, it will be the direction of the ship's course, on which measuring off the distance sailed 156 miles, the ship's place at the end of the run will be obtained. If from this last point a line be let fall perpendicularly on the meridian of the cape, it will cut it in a point showing the latitude of the ship's place come to, and the perpendicular itself will show how much she has departed westerly from that meridian.

By this process will be formed a rightangled triangle of which the angle of the course, (and consequently its complement to 90°), with the hypothenuse or distance run being given, we can by the rule given in case 4th of rightangled trigonometry, (vol. i. p. 415) discover the remaining sides: thus,

For the Departure.

As radius - -	90° 00′	=	10.00000
To the sine of the angle of the course	33 45	=	9.74474
So is the hypothenuse or distance	156	=	2.19312

To

To the base or departure -	86.7	=	1.93786

Again for the Difference of Latitude.

As radius - - -	90° 00′	=	10.00000
To the co-sine of the course	33 45	=	9.91985
So is the distance - -	156	=	2.19312
To the perpendicular or Difference of Latitude - - -	129.7	=	2.11297

This difference of latitude being divided by 60 gives 2 degrees 9.7 or nearly 10 minutes; and the ship having sailed from a N. latitude southerly, consequently nearer to the equator, that quantity subtracted from the lat. of the cape 37° 3′, leaves 34° 53′ N. for the latitudes come to at the end of her course, and she has departed 86.7 or 87 miles to the westward of the meridian of the point where she set out.

CASE 2d.—*Given the course and the difference of latitude, to find the distance and departure.*

A ship from a port in N. lat. 22° 36′ sailed on a course NNE½E, until by observation she came to be in lat. 26° 14′, required the distance run, and the departure easterly from the meridian of the port.

The course NNE ½ E or two points and a half to the eastward of N. forms an angle of 28° 7½′: the difference of lat. between the first and last stations of the ship 22° 36′ and 26° 14′ is 3° 38′ equal to 218 nautical miles: we have therefore in a rightangled triangle the angles and one of the sides, and by Case 3d of rightangled trigonometry, (vol. i. p. 414), the other side and the hypothenuse may be found, thus.

As the sine of the complement of the course - -	61° 52½′	=	9.94543

To

To radius - -	90. 00 =	10.00000
So is the diff. of lat. -	218 =	2.33846
To the distance - -	247.2 =	2.39303

Again for the departure.

As radius - - - -		10.00000
To the tangent of the course -	$28^\circ\ 7\frac{1}{2}'$ =	9.67328
So diff. of latitude - -	218 =	2.33846
To departure easterly -	102.8 =	2.01174

CASE 3d.—*Given the distance run and the diff. of lat. to find the course sailed and the departure.*

A ship from James-town in St. Helena in S. lat. 15° 55′ sails 238 miles between N and W until she comes into lat. 12° 51′, required the point of the compass on which she sails and her departure from the meridian of St. Helena.

By the application of the rules given in case 2d of right-angled Trigon. (vol. i. p. 413) if the distance be made radius the diff. of lat. will be the sine of the complement of the course or $50^\circ\ 37\frac{1}{2}'$, consequently the course itself $39^\circ\ 22\frac{1}{2}'$ which divided by 11° 15′, the quantity contained in 1 point of the compass will quote $3\frac{1}{2}$ points; and as the ship sailed between N and W this quantity reckoned on the compass to the westward of N will point out NW $\frac{1}{2}$ N for the course held during the run in question. By means of the distance and diff. of lat. the departure will be found 151 miles westerly from the meridian of James-town.

These three cases include all the possible varieties of plane sailing, for other cases in which the departure is supposed to be given can never occur, since that departure can never be discovered but from the previous knowledge of the course, distance, and difference of latitude, or at least of some two of these particulars.

TRAVERSE SAILING.

When a ship is bound from one port to another for which the wind is so unfavourable that she cannot steer a direct course towards it, she sails in a zig-zag direction with the wind sometimes on the one side and sometimes on the other, but in each course gaining a little on her voyage; this is called *traverse sailing*. For other reasons also as in cruising in any quarter for the purpose of falling in with an enemy, or waiting for other vessels to sail in company, ships may find it necessary to make a number of runs on different points of the compass. In all such cases the several courses and distances sailed in the space of 24 hours are entered in a table and the true position of the ship is determined as in the following example.

A ship from a port in N. lat 33° 50′ is bound to another situated to the northward, but by reason of contrary winds is obliged to sail first ENE 20 miles, then WNW 26 miles, E by N 18, N by W 27, SW 13, NW by W 22, W by S 15, and lastly NNE 32 miles: required the ship's place at the end of the traverse, her bearing and distance from the place whence she sailed, the departure and the latitude come to.

Let a table be constructed in the following form, containing columns for the courses, distances, diff. of lat. divided into N and S, and departure divided into E and W.

TRAVERSE

TRAVERSE TABLE.

Courses.	Distances.	Diff. of Lat.		Departure.	
		N	S.	E	W
	Miles				
E N E	20	7.7	....	18.5	....
W N W	26	9.9	....	....	24.
E by N	18	3.5	....	17.7	....
N by W	27	26.5	....	....	5.3
S W	13	....	9.2	....	9.2
N W by W	22	12.2	....	....	18.3
W by S	15	....	2.9	....	14.7
N N E	32	29 6	....	12.2	....
		89.4	12.1	48.4	71.5
		12 1			48.4
N 16° 38′ W	80.7	77.3			23.1

Latitude sailed from -	33° 50′ N.
Diff. of lat. 77.3 minutes or	1. 17 . 3
Latitude come to - -	35. 07. 3 N.

This table is divided into four columns appropriated for courses, distances, difference of latitude and departure: the column for diff. of lat. being subdivided into two columns for the northing and southing, and the column for departure also into two for the easting and westing.

The first course sailed by the ship is ENE 20 miles: calculating as directed for plane sailing where the course and distance are given, we find the difference of latitude on that run to be 7.7 miles or minutes, to be entered in the column for northing as the course lies to the northward; and the departure found in a similar way 18.5 miles, is entered in the column for easting as the course lies also

 to

to the eastward. In this way the diff. of lat. made good by the second course WNW 26 miles, is entered in the column for northing, and the departure in that for westing, agreeably to the nature of the course between N and W. The fifth run likewise being SW 13 miles, the diff. of lat. and departure are entered in the columns for southing and westing, the course lying between S and W.

When the diff. of lat. and departure for all the given courses and distances have been calculated and entered in their respective columns, each column is summed up and the amount entered at the bottom: thus in the preceding example the northing is 89.4 miles, the southing 12.1 miles, the easting 48.4, and the westing 71.5. Subtracting the southing from the northing, the remainder 77.3 miles or 1 degree 17.3 minutes is the total diff. of lat. made good upon the whole traverse; and it is northerly because the column of northing is the greatest. In the same way subtracting the easting from the westing the remainder 23.1 miles is the total departure on the whole traverse from the meridian of the port whence the ship sailed: and it is westerly, for the column of westing is the greatest.

We have now obtained a simple case of plane sailing in which the difference of latitude and the departure are given, and the course and the distance are required. By case 1st of plane sailing, if a ship from a port in N. lat. sail between N and W until her difference of latitude be 77.3 miles, and her departure 21.1, her distance will be found 80.7 miles, and her course will form an angle of 16° 38′ on the W side of the N part of the meridian of the place sailed from: hence it appears that after a vessel has run down the several courses and distances before given, amounting to not less than 173 miles, she will have advanced in fact only 80.7 miles in her voyage from the point of departure, and that after all the various directions in which she may have sailed the course made good on the whole will be N 16° 38 W, nearly

nearly $1\frac{1}{2}$ to the westward of N, or N by W $\frac{1}{2}$ W. If to the latitude of the place sailed from 33° 50′ N we *add* the difference of latitude now discovered 1° 17.3′, the ships course carrying her farther to the northward of the equator, we obtain 35° 07.3′ N. lat. for her place at the end of the traverse.

In complete treatises on navigation tables are found containing the difference of latitude and the departure, corresponding to any given distance from 1 mile to 100, 200, 300, miles according to the extent of the tables, and to every course from one quarter of a point to $7\frac{3}{4}$ points, as also to every degree of the quadrant. By the use of such tables much time and labour may be saved to the mariner: but as it is almost impossible to prevent errors from creeping into numerical tables through the inadvertency of the calculator or the printer, it is always desirable that the difference of latitude and the departure should be calculated, conformably to the rules laid down in the preceeding cases of plane sailing.

Parallel Sailing.

Hitherto the earth has been considered as one vast extended plane, having the degrees of latitude and longitude every-where of equal dimensions; this supposition however we know to be false, and in navigation it must be the source of many errors of the greatest importance to seamen. The earth being in fact spherical, the circles of latitude drawn round the poles and parallel to the equator, diminish in circumference in gradation as they recede from the equator; and consequently all these parallels being supposed to be divided into the same number of degrees of longitude, 360, each degree must occupy a space on the globe greater or smaller in a certain ratio to its distance from the equator or the poles. This ratio is that of the sine of the complement of the latitude to radius, so that knowing the latitude of

any

any place we can discover how much of the circumference of the earth on that parallel corresponds to any given portion of the circumference at the equator. Thus for example, a degree of longitude on the equator containing 60 minutes or nautical and geographical miles, a degree of longitude at London, situated in N. lat. 51° 31′, will contain only 37½ of the same miles.

As radius - - -		=	10.00000
To S. comp. of lat. or of -	38°. 29′	=	9 79399
So 60 m. = 1 deg. at equator -		=	1.77815
To m. in 1 deg. at London -	37. 34	=	1. 7214

About 37½ nautical miles therefore at London or any where else in 51° 31′ N. lat. is equal in longitude to 60 of such miles at the equator.

By this example when the difference of longitude between any two places situated on the same parallel of latitude is given, we can discover their distance, and *vice versa*, from their distance we can discover their difference of longitude: thus if a ship sail from a port in N. lat. 45° 30′ to another situated due W. from the former, or on the same parallel of latitude, but differing in longitude 35° 20′, what is the real length of her voyage in nautical miles or minutes of a degree on the equator?

The difference of longitude 35° 20′, reduced into minutes is 2120 minutes of the equator, which quantity employed as the 60 m. in the former example, will give the number of nautical miles of distance between the two ports.

As radius - - -	=	10.00000
To co-s. of lat. 45°. 30′ - -	=	9.84566
So diff. of long. on the equator 2120′	=	3.32634
To diff. of long. in miles on the parallel of the given latitude, equal to the true distance 1485	=	3.17200

Again

Again if the distance between the two ports both in N. lat. 45° 30′, be given 1485 nautical miles, by reversing the proportion we have this formula for discovering the diff. of longitude.

As co-sine of lat. 45°. 30′ -		=	9.84566.
To radius - - -		=	10.00000
So distance 1485 miles - -		=	3.17200
To diff. of long. in minutes	2120	=	3.32634
Equal to - -	35° 20′		

A ship from a port in N. latitude and W. longitude, sails due W. for 1485 nautical miles, and then finds by observation her difference of longitude to be 35° 20′; required the latitude of the parallel on which she sails.

To solve this case the following proportion formed on the foregoing is to be employed.

As given diff. of long. 35°. 20′ =	2120′	=	3.32634
To given distance -	1485	=	3.17200
So is radius - -	90°.00′	=	10.00000
To co-sine of latitude of the parallel on which the ship sailed	45°.30′	=	9.84566

Middle Latitude Sailing.

This is a method of solving problems in navigation where the ship's course on the globe is neither on a meridian N or S, nor on a parallel of latitude E or W, but in a direction oblique to both; and it is so named because in the calculations use is made not of the parallels sailed from or come to, but of that lying in the middle equidistant from both. This method is not however strictly correct, as it gives always a result somewhat less than the truth; but in short runs near

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the equator, and on courses diverging less from the parallel of latitude than from the meridian of the place sailed from, the ship's place may by it be discovered with sufficient accuracy for ordinary purposes.

To conceive whence arises the inaccuracy of middle latitude sailing we must consider that the course performed by a ship sailing in any direction between the meridian and the parallel of latitude of the point of departure is very different from the circumference of a great circle of the globe passing through that point, or crossing the equator at an angle of inclination equal to that of the ship's course. Supposing there existed a globe in all respects similar to this earth, excepting that its surface entirely covered with water were freely permeable to shipping in every direction: supposing also that this globe were cut by the plane of a great circle passing through its center in any direction inclined to the equator and the meridian of the point of intersection, as for instance in a NE direction or in one equidistant between N and E, that is, making an angle of 45° with both the equator and the meridian of the point of intersection. Were the meridians all situated in one plane, and parallel the one to the other, the plane of this great circle would form with each an angle of 45°, equal to that formed with the first meridian, (Geom. vol. i. p. 353): but as this is not the case, the meridians converging to and centering in the pole, it is evident that the circumference of the given great circle must form with each successive meridian an angle more and more deviating towards E from the original inclination NE, until at the distance of 90° from the first meridian it cut the meridian at right angles or in a direction due E. Proceeding for another 90°, the circumference will cross the equator to the S. at an angle of 45°, or in a direction SE; when arrived at the 3d quadrant it will again be at right angles to the southern meridian, and at last return to the original point of intersection, forming an angle with the equator of 45°, or in a direction

direction NE as at the beginning. Let us now suppose a ship leaving the first meridian at the point where the great circle crosses the equator to the northward and steering NE, her course may for a short space be considered as coinciding with the great circle; but when she arrives at a meridian 1° to the eastward of the first, not parallel to it but pointing to the N pole, their common point of meeting, the direction of her course must be a little inclined to the northward, so as still to form an angle of 45° with the second meridian. Proceeding NE until she come to the third meridian, 1° to the eastward of the second, her course must again be a little deflected to the northward in order to form with this third meridian an equal angle of 45°; by which process her course will not only depart to the northward of the circumference of the great circle on which she set out, but if we suppose her to sail quite round the globe in a NE direction, continually bisecting the angle formed by the meridian running northerly, and the parallels of latitude running easterly, her course will describe a winding or spiral curve line on the surface of the globe, continually approaching the north pole but never falling into it, inasmuch as the NE course always lying midway between N and E, it never can deviate into due N, which last course alone can in correct geometrical language bring the ship to the N pole. It is this constant tendency of the ship's course to approach the pole and deviation from the direction of the preceding portions of her course which occasion the inaccuracy in the ordinary computations by the middle latitude sailing, giving results constantly less than the truth.

In solving problems by middle latitude sailing the following rules are to be observed.

Case 1st.—*Given the latitudes and longitudes of two places; required the course or bearing and the distance between them.*

Required the bearing or course and distance between Cape

Clear, the southern extremity of Ireland, in N. lat. 51° 19′, W. long. 9° 23′ and isle of Ushant on the coast of France, in N. lat. 48° 29′, W. long. 5° 5′.

Lat. of Cape Clear	51° 19′	Long. of do.	9°.23
——Ushant -	48 29	————	5.05
Diff. of lat. -	2 50	Diff. of long.	4.18
	60		60
Minutes	170	Minutes	258

Lat. of Cape Clear	51° 19′
——Ushant -	48 29
Sum of Latitudes	99 48
½ or mid. lat. -	49 54

With these *data* to find the course we have the following proportion,

As diff. of lat - -	170	=	2.23045
To diff. of long. - -	258	=	2.41162
So co-sine of middle latitude	49°.21′	=	9.80897
To tang. of course -	44°.21′	=	9.99014

Again to find the distance between the two given places, we say,

As radius - -	90. 00	=	10.00000
To secant of course -	44°.21′	=	10.14564
So diff. of lat. - -	170	=	2.23045
To distance - -	238	=	2.37609

From Cape Clear, therefore, to Ushant is a distance of 238 nautical miles, and the course is S 44° 21 E, or SE 39′ S.

CASE

CASE 2d.—*Given the latitude and longitude sailed from, the course and distance, required the latitude and longitude come to.*

A ship from Cape St. Vincent in N lat. 37° 3′, W long. 8° 59′, sails SW by W 560 miles; required the latitude and longitude come to.

As radius - - -			10.00000
To co-sine of course -	56° 15′	=	9.74474
So distance - -	560	=	2.74819
To diff. of lat. - -	311	=	2.49293
	5° 11′		
Lat. sailed from - -	37.03		
Lat. come to - -	32.52 N.		
Sum of latitudes -	69.55		
Half or middle latitude -	34.57½		

Then for the difference of longitude.

As co-sine of mid. lat. -	34° 57½′	=	9.91363
To sine of course -	56 15	=	9.91985
So distance - -	560	=	2.74819
To diff. of long. - -	568	=	2.75441
	9° 28′		
Long. sailed from -	8 59		
Long. come to - -	18 27 W.		

Hence we find that the ship will have arrived at a point in N. lat. 32° 52′, and in W. long. 18° 27′, as was required to be discovered.

CASE 3d.—*Given both latitudes and the course, to find the distance and difference of longitude.*

A ship from the Lizard in N. lat. 49° 58′, W. long. 5° 11′ sails SW ½ W until she come into N. lat. 43° 20′, required the distance run, and the longitude come to.

Lat. of the Lizard	-	49° 58′	Lat.	-	49° 58
Lat. come to	-	43 20	Do.	-	43 20
Diff. of lat.	=	6 38			93 18
		60			
			Mid. lat.		46 39
In minutes	-	398			

For the distance.

As radius	-	-	-	10.00000
To secant of course, 4½ points	=	50° 37½′	=	10.19766
So diff. of lat.	-	398	=	2.59988
To distance	-	627	=	2.79752

For the difference of longitude.

As co-sine of mid. lat.	-	46° 39′	=	9.83661
To tangent of course	-	50 37½	=	10.08578
So diff. of lat.	-	398	=	2.59988
To diff. of long.	-	706	=	2.84905
		11° 46′		
Long. of Lizard	-	5 11		
Long. come to	-	16 57 W.		

CASE 4th.—*Given both latitudes and distance, to find the course and difference of longitude.*

A ship from the Spurn in N. lat. 53° 41′, E. long. 0° 17′, sails 220 miles in the NE quarter, and then finds by observation

observation her latitude to be 56° 16′, required the course and the longitude come to.

Lat. of Spurn	53° 41′	Lat. of Spurn	53° 41′
Lat. come to	56 16	Lat. come to	56 16
Diff. of lat. -	2 35	Sum -	109 57
	60	Mid. lat.	54 58½
In minutes	155		

For the course.

As distance - - -	220	=	2.34242
To diff. of lat - -	155	=	2.19033
So radius - - -			10.00000
To co-sine of course -	45° 12′	=	9.84791
or NE 12′ E.			

For the difference of longitude.

As co-sine of middle lat.	54° 58½′	=	9.75886
To sine of course -	45 12	=	9.05100
So distance - -	220	=	2.34242
To diff. of long. -	272	=	2.43456
	4 32		
Long. of Spurn -	0 17 E.		
Long. come to -	4 49		

Mercator's Sailing.

As it is impossible on a plane surface to lay down with accuracy any considerable portion of the surface of a sphere, all maps and charts in which the meridians and parallels of latitude

latitude are represented by straight lines, cutting one another at right angles and at equal intervals, must necessarily be erroneous. To remedy this inconvenienec, various contrivances have been adopted, of which that possessing the greatest advantages is the method made known to the world by *Gerard Mercator*, a native of the Netherlands, who in 1569, produeed a chart in which the parallelism of the meridian was retained, but the parallels of latitude were placed at intervals increasing in magnitude as they receded from the equator towards the poles; thus by one error counterbalancing another, and presenting a ehart which, although it contained no correct resemblance to any portion of the earth's surface, and particularly in high latitudes, yet admitted of a ship's course being laid down in a straight line on any point of the compass, whilst distances might be measured on it with the greatest aceuracy. This contrivance of Mercator naturally attracted the notice of the learned; and in 1599 *Edward Wright* of Cambridge, published a treatise written many years before, in which he entered into the geometrical principles of the construction of such a map or chart, from which it became probable that Mercator had prceeded on a general notion of correcting one error by another, without rightly understanding the true grounds on which sueh corrections were to be founded.

In speaking of parallel sailing, it was observed that any portion or the whole circumference of a parallel of latitude was in proportion to a corresponding portion, or the whole circumferenee of the equator in the proportion of the sine of the complement of the latitude of the given parallel to radius. Precisely analogous to this ratio is that of radius to the sine of the complement of the given latitude, or the secant of the latitude is to radius as the whole, or a portion of the equator to the whole, or a corresponding portion of the given parallel. In the true Mercator's chart or map, therefore, where the meridians are all drawn parallel instead

instead of converging to the poles, if we take from a scale of equal parts the sum of all the secants of the minutes, or other small equal portions contained in that latitude, and set it up from the equator, we have the position of the parallel of the given latitude. This being done to every degree, or other convenient division comprehended within the limits of the proposed map or chart, one will be produced perfectly well adapted for performing operations in navigation; but in high latitudes the positions of places and countries will be distorted and erroneous in proportion to their increased distance from the equator. The meridians being all parallel right lines, but the parallels of latitude being placed at intervals constantly increasing in a given proportion, it is evident that the length of a degree of longitude at any given latitude will, on a Mercator's chart, bear to the length of a degree of latitude on the meridian at that parallel precisely the same proportion as they do in fact on the earth where the degrees of the meridian are (in a general sense) all equal, but where the meridians tending to meet at the poles, the degrees of longitude must continually decrease as they recede from the equator. (Vol. II. p. 19, &c.)

Upon these principles tables have been formed containing the proportional magnitudes of each minute of latitude measured along a meridian from the equator to the poles: they are called tables of *meridional parts*, and are to be found in all complete treatises on Navigation. The meridians in the vicinity of the equator deviate so little from a parallel direction, that as far as latitude 6° the meridional parts or minutes do not sensibly differ from those on the globe, but at that parallel the meridional parts are 361 instead of 360, the minutes in 6°; and in higher latitudes, where the degrees of longitude are much shorter than those of latitude the meridional parts are greatly increased; thus at London in lat. 51° 31′ where a degree of longitude contains 37.34 minutes

minutes of the equator, the meridional parts of a degree in minutes are 3618, instead of 3371, the minutes in 51° 31′.

If as in plain sailing, a right angled triangle be constructed in which the hypothenuse represents the distance run by the ship on a given course, the perpendicular the difference of latitude, and the base the departure from the meridian of the place sailed from; if now the perpendicular be prolonged, and on it be laid off the meridional parts corresponding to the difference of latitude, and another base be drawn parallel to the departure, and meeting the distance or hypothenuse produced, this last base will represent the difference of longitude made good on the given course and distance; consequently the two triangles will be similar and their corresponding sides respectively proportional (Geom. Prop. 19 vol. i. p. 371): hence we have the means of solving the following cases in Mercator's sailing.

CASE 1st.—*Given the latitude and longitude sailed from, with the course and distance run by the ship, to find the place come to.*

If a ship from the Lizard in N. lat. 49° 58′, and W. long. 5° 11′ sail SW. by S. 560 miles, what is her place at the end of the course?

By the rule given in plain sailing we have this proposition:

As radius	-	-	10.00000
To co-sine of course, 3 points	33° 45′	=	9.91985
So distance -	560	=	2.74819
To difference of lat. -	466	=	2.66804
	7° 46′		

Lat.

Lat. of Lizard	49° 58′ N.	——Merid. parts	3379
Diff. of latitude	7 46 S.		
Lat. come to	42 12 N.	——Merid. parts	2798
Diff. of latitude in meridional parts		-	581

For the difference of longitude.

As radius -			10.00000
To tangent of course	33° 45′	=	9.82489
So meridional diff. of latitude	581	=	2.76418
To difference of longitude	38 8	=	2.58907
	6° 28′		

Long. of Lizard -	5° 11′ W.
Difference of longitude -	6 28 W.
Longitude come to	11 39 W.

The ship's place therefore at the end of her course is in N. lat. 42° 12′ and W. long. 11° 39′.

Case 2d.—*Given the latitude and longitude of two places, to find their distance and bearing.*

Required the distance and course from the Land's End, in N. lat. 50° 4′, W. long. 5° 42′, and Bridge Town, Barbadoes, in N. Lat. 13° 5′, W. long 59° 40′.

Lat. of Land's End	50° 3′ N.	——Merid. parts	3481
——— of Bridge Town	13 5 N.	——Merid. parts	792
Difference of latitude	36 59	—Mer. diff. of lat.	2689
	60		
Minutes -	2219		

2 R

Longitude

Longitude of Land's End	5° 42′ W.
——— Bridge Town	59 40 W.
Difference of longitude	53 58
	60
Minutes -	3238

To find the course.

As Merid. difference of lat.	2689	=	3.42959
To difference of long. -	3238	=	3.51028
So radius -		=	10.00000
To tangent of course -	50° 18′	=	10.08069

This quantity laid off on the W. side of the meridian of Land's End gives a course S. 50° 18′ W. or nearly 4½ points, or SW ½ W.

The distance is found by this formula.

As S. of course -	50° 18′	=	9.88615
To radius -	-		10.00000
So difference of longitude	3228	=	3.51028
To distance -	4210	=	3.62413

Hence the direct course and distance from the Land's End to Barbadoes are S. 50° 80′ W. or nearly SW ½ W. 4210 nautical miles.

The difference of longitude made good on a series of courses run down in one day, as in the table given in Traverse Sailing, may likewise be found by the use of the meridional parts, thus

Lat. sailed from	33° 50′ N.	——Merid. parts	2159
Lat. come to	35 07 N.	——Merid. parts	2253
Difference of lat.	1 17 N.	——Merid. dif. of lat.	94

Then

Then by Case 1st of Mercator's sailing,

As radius	-	-	10.0000
To tangent of course	16° 38′	=	9.47530
To merid. difference of lat.	95	=	1.97313
To difference of long.	28	=	1.44843

This difference of longitude is westerly, because the column of westerly departure is greater than that for easterly departure. It is, however, more accurate to calculate the difference of longitude on each separate run than as here to compute it in all the runs made in one day.

N. B. Maps or charts constructed on Mercator's, or to speak correctly on Wright's principles, are called by the French *Cartes réduites*, and by the Spaniards *Cartas esfericas* or *reducidas*, terms signifying reduced or spherical charts and maps.

Oblique Sailing.

Under the head *Practical Geometry* (vol i. p. 425) were given rules for the application of trigonometry, both right angled and oblique angled, in the measurement of distances accessible and inaccessible: the same rules are equally applicable to certain parts of navigation, as in running along a coast to determine the ship's distance from it by observing the bearings and distance between objects on shore, in making the survey of a bay or other portion of the coast, &c. as in the following examples:

1st. A ship in passing down the English Channel observed at 10 o'clock A. M. that the Start Point, in Devonshire, bore W. by N. and at two P. M. the ship in the mean time running S. W. by W. four knots (that is miles) per hour, the same point was again observed to bear NNE: required the distance of the Start from the ship at each place of observation.

At the first station the point bore from the ship W. by

 N.

N. or one point to the northward of W.; she then steered SW by W. that is three points to the southward of W. the angle thus formed at the first station by the bearing of the point and the ship's course must have been four points or 45°. Again at the second station the Start bore NNE. or two points to the eastward of N. while the course sailed, reversed that is NE by E. from the same second station was five points from N. the difference between these two bearings three points or 33° 45′ is the angle formed at the second station.

Having thus in a plane triangle two angles given 45° and 33° 45′, their sum 71° 45′ subtracted from two right angles 180° will leave 101° 15′ for the angle formed at the Start by lines drawn to the ship at both stations: the side representing the ship's course is also given, for she sailed four miles an hour for four hours, in all 16 miles between the places of observation.

It was shown in Prop. 2 of Trignometry (vol. i. p. 405) that in all plane triangles the sides are to each other in the proportion of the sines of the angles respectively opposite to each. In the present case we have all the angles and one side, if then we state the proportion, as the sine of the angle at the Start opposite to the given side or ship's course 101° 15′ to the sine of the angle at second station 33° 45′ so is the given side 16 miles to the ship's distance from the Start at the first place of observation, which will be found a little more than nine miles. Working in a similar way for the remaining side of the triangle, as the sine of the angle at the Start 101° 15′ to the sine of the angle at the first station 45°, so is the given side or ship's course 16 miles to the ship's distance from the Start at the second station, which comes out to be a little more than $11\frac{1}{2}$ miles (See vol. i. page 430.)

2d. A ship coming in with the land in the night observed two light-houses, the first N. 20° 15′ E. and the second

second N. 53° 40′ W. the ship stood on in a due W. course for 12 miles, and again observed the first bearing N. 56° 09′ E. and the second N. 9° 28′ W: required the distance of the ship from both light-houses at each station, also the bearing and distance of the one light-house from the other.

In this example we have two triangles, of which are given all the angles and one side common to both. The other sides may therefore readily be found by employing the proportion that the sides are to each other as the sines of the angles opposite to each respectively; and the manner of performing the whole problem may be seen in Example 5th of Pract. Geom. page 431 of vol. i.

The first thing to be done is to determine the quantity of the angles formed at the ship at both stations, by lines drawn to each light-house, and by the line of her course: thus at the first station the first light bore from the ship 20° 15′ to the eastward of N. while the second light bore 53° 40′ to the westward of N. these two quantities therefore added together will give the angle formed at the first station by lines from both lights, equal to 73° 55′. Again at the second station, the first light was observed to bear 56° 09′ E. of N. while the second light bore 9° 28′ W. of N. the sum of these two quantities 65° 37′ is the angle formed at the second station by lines drawn to the two lights.

Further, by subtracting from the angle of the ship's course, due W or 90° the bearing of the second light from the first station 53° 40′, we obtain the angle formed at the first station by the bearing of the second light, and the ship's course 36° 20′; and subtracting the bearing of the first light from the second station 56° 09′ from 90°, we obtain the angle formed by that bearing and the ship's course 33° 51′

Lastly, by adding together the angles formed at the two stations by the ship's course, and lines drawn to the first light, we obtain 35° 54′; for the angle formed at the first light,

light by lines drawn to the ship at both stations: in the same way the angle formed at the second light by lines drawn to each station comes out 44° 12′.

Employing now these angles and the given side or ship's course, 12 miles, we find the distances of the ship at both stations from each light-house to be the following:

At the first station.

The first light-house bore -	N 30° 15′ E	11.4 miles
The second - -	N 53 40 W	17

At the second station.

The first light-house bore -	N 56° 09′ E	19.2 miles
The second - -	N 9 28 W	10.2

We are next to calculate the distance and bearing between the two light-houses themselves, which may be done from either station; thus having discovered the distance from the ship at the first station to each light, and the angle formed at that station by their bearings being given, we discover the remaining side opposite to the given angle to be 17.6 miles (see Case 3d of oblique-angled Trigon. vol. I. p. 420.)

Then in the triangle formed by lines from the first station to both lights, and by that from the one light to the other, knowing all the sides the angles are readily discovered: by this means the angle formed at the second light by lines to the first light, and the first station is found to be 38° 24′, which added the bearing of the second station from the second light, S. 9° 28′ E, (N 9° 28′ W. reversed) will give the bearing of the first light-house from the second S. 47° 52′ E. The two light-houses, therefore, bear the one from the other, N 47° 52′ W, and S. 47° 52′ E, distance 17.6 miles, the things required to be known.

This problem is the foundation of the practice in making a survey of a bay or other tract of coast, where it is incon-venient.

venient or impracticable to perform the operations on shore; for by carefully observing the true bearings of objects on the land, and measuring the courses and distances run by the ship from one place of observation to another a series of triangles may be formed, of which all the angles are either given or may readily be calculated, and one side is given, that is the ship's course from station to station.

Windward Sailing.

Were a ship or other inert body to be placed in and acted upon by one substance or medium only it would remain at rest or move precisely in the direction and with the velocity of the surrounding medium: but if, as is the case with a ship, one part of the body, the hull, is immersed in one medium, the water, while another part, the rigging, is surrounded by a different medium, the air or wind, the motion impressed on the ship will be compounded of the effects of the resistance of the different fluids in which she is inclosed; her motion through the water will, therefore, be much slower than that of the wind, in proportion to the greater density and resistance of the water above those of the air; and the pressure of the wind on the ship must amount to a certain quantity exceeding the opposite pressure or resistance of the water before the ship can move at all.

From the structure of the hull of a ship, narrowing gradually to a sharp edge, and also from the arrangement of the sails, by which the pressure of the wind is made to act in a direction oblique to its own, a ship under the impulse of the air, instead of moving forward in the course of the wind, is pressed on with the sharp end forwards, in a course inclined to the direction of the wind, varying according to the circumstances of her construction and management.

Suppose the wind to blow from the N off a shore stretch-

ing

ing E and W, and that a ship out at sea could make good her way only E or W; in such a case she would sail for ever parallel to the land, neither approaching to nor receding from it. When the water, however, is sufficiently smooth, and the wind is only so strong as to admit the ship to carry a due proportion of sail, it is found by experience, that she will make her course good at an angle, considerably less than a right angle, with the direction of the wind. Suppose the wind as above stated, to blow due S, that is to be a north wind, and that the ship can according to the sea phrase, ly within 6 points of the wind; that is, in standing along the land to the westward, instead of running due W, she can make her way good 6 points W from N, or WNW, her course being no longer parallel, but inclined to the direction of the shore, she must at last fall in with it. If a ship is bound to a port situated due N from her, while the wind blows due S, and that she can make her way good within 6 points of the wind, she may run either WNW, or ENE at pleasure; let her run WNW for a certain time, by which she will gradually approach the land, and then turning about, or tacking so as to bring the other side to the wind, she will from that point run within 6 points of the wind in the NE quarter, or ENE in the same way, still gaining upon the land. By continuing these courses, or *boards* as they are called for the requisite distance, she will at last arrive at the desired port: and this part of navigation is termed windward sailing, or turning to windward.

A ship on the western side of an island, lying N and S, is bound to a port due N 36 miles, but the wind being also due N, she can only turn up against it to the westward, making her way good within 6 points of the wind: it is required to ascertain how far she must run to the westward, in order, on putting about and standing to the eastward, to reach the port.

From this statement, it is evident that the ship must run an

an equal distance in both directions, thus forming two sides of an isosceles triangle, of which the base is given 36 miles, and the angles at the base each containing 6 points of the compass, or 67° 30′, consequently the angle at the vertex, or that formed by the two courses, will be 45°; for as she can sail within 6 points of the wind, her first course will be WNW, and the second also within 6 points of N must be ENE, the angle formed by which with the first course reversed ESE, is 4 points or 45°.

We have now obtained a simple case of oblique-angled trigonometry, having all the angles and one side of a triangle to find the other sides :—saying therefore

As sine of angle at vertex	-		45°.00′		9.84949
To sine of angle of course	-		67.30	=	9.96562
So base	- -	miles	36	=	1.55630
To side	- -	miles	47	=	1.67243

Consequently the ship must run first out to sea WNW 47 miles, and then to the land ENE 47 miles, to arrive at the port in view.

Had it been preferred to perform the same voyage on 4 boards, 2 WNW, and 2 ENE, the distance run upon each would have been one-half of the above, or $23\frac{1}{2}$ miles; so that the whole number of miles run down would still have been the same or 94, to gain a port situated 36 miles off.

Current Sailing.

Although the ocean be confined within certain bounds which, unless in the case of the rise and fall of the tides, it never transgresses, yet in many parts of this vast body of water, portions are observed to move in various directions; in one place constantly advancing, in others at one time advancing and then returning to their original place. To these partial motions of the ocean we give the name of *cur-*

 rents,

rents, or *setting of the waters*; and they are not only partial with respect to the surface of the sea, but also with respect to its depth; for counter currents are often met with, where the water on the surface is found to set in one direction, while that nearer the bottom is proceeding in a contrary direction. Similar effects are observable in the atmosphere, where the upper range of clouds may often be observed in progress towards one point of the heavens, at the same time that those floating in a lower region of the air are following a course directly contrary, or in some way inclined to that of the upper clouds.

A ship in the midst of a current, or in a river, and not acted upon by any wind, will follow the course of the stream, proceeding conformably to the rate and the direction of the waters, so that if the stream travel 2 miles in an hour, the ship's progress will likewise be 2 miles in an hour; should, however, the wind blow in the direction of the current, with such force as would impel the ship, if in perfectly still water, at the rate of 2 miles in the hour, this effect will be produced in the current, and the ship pushed forward by the wind 2 miles in 1 hour, at the same time that the current in which she is placed carries her forward 2 miles in the same time, it is evident that the ship will have made a progress equal to the sum of the 2 moving forces, or at the rate of 4 miles in the hour.

On the other hand, should a vessel have to advance against a current or stream, setting 2 miles in the hour, with a wind in her favour just sufficient to carry her forward 2 miles per hour in still water, the two opposing forces being equal, the one would precisely counterpoise the other, no effect in any direction would be produced, and the vessel would preserve her position unchanged, as if in dead water, where neither current nor wind were perceptible. Were the current, however, to set down the river at the rate of 3 miles per hour, while the wind continued to blow against it

it at the rate of 2 miles, the effect of the current measured by the excess of its rate of motion above that of the impelling force of the wind, or 1 mile, would draw the ship downwards against the wind 1 mile in the hour. On the other hand, should the wind act on her at the rate of 5 miles in the hour, while the contrary stream proceeded at the rate of 2 miles, the excess of 5 above 2, or 3 miles, would be the hourly progress of the ship before the wind, and against the stream.

It must often happen that a ship's course, neither directly following, nor opposing the direction of a current, shall cross it perpendicularly, or in any angle of inclination, in such cases the course really traced out by the ship, will be compounded of the direction in which she appears to steer, and that of the setting of the current; or in other words, the actual course of the ship will be the diagonal of a parallelogram, whose sides are in magnitude and mutual inclination representatives of the rate of motion and of the direction of the course steered by the ship, and the setting of the current. Thus, if a ship steer due E at the rate of 3 miles in an hour in a current setting due N at the same rate, the course actually made good will be in the direction NE, and the distance actually passed over in 1 hour will be 4.24 or nearly $4\frac{1}{4}$ miles.

If we construct a parallelogram, each of whose sides is equal to 3 miles, the one representing the distance which the wind would carry the vessel in 1 hour, and the other the distance to which she would be drawn by the current in the same time, and right-angled because the course blows E, while the stream sets N; and if we draw a diagonal in this parallelogram or square which must be in the direction NE, this diagonal will represent the direction of the course made good, and its length will be the distance run in the space of 1 hour, or $4\frac{1}{4}$ miles, the square

root of the sum of the squares of the sides of the rectangular parallelogram.

Again, if a ship steer 4 hours due W, at the rate of 6 miles per hour, in a current setting SW by W 2 miles per hour, what will be the course and distance actually made good?

The setting of the current SW by W forms with the course steered by the ship W an angle of 3 points or 33° 45′ to the southward of W: if, therefore, a parallelogram be constructed, of which the longest side extends from E to W 24 miles (the distance measured by the ship in 4 hours sailing at the rate of 6 miles per hour), and the shortest side from NE by E to SW by W 8 miles (the distance run by the current in the same time), and the angle formed by these two sides be made 33° 45′ equal to 3 points of the compass, the diagonal of this parallelogram will in magnitude and position represent the distance and course made good by the ship, which in this case will be found W 8° 41½′ S 31.5 miles; for in the oblique angled triangle formed by the distance measured by the ship 24 miles, the setting of the current in the same time 8 miles, and the diagonal of the parallelogram, the angle contained between the two former sides is given, being the supplement of the angle made by the current with the course steered, or 146° 15′; it is easy, therefore, by Case 3d of oblique-angled Trigon. (vol. i. p. 420) to calculate the remaining side and angles of the given triangle.

Having thus attempted to give the young student a competent although succinct notion of the different methods of calculating a ship's place on the sea, by both celestial observation, and a mechanical ascertainment of her course and distance sailed from a given point, it may gratify his curiosity to subjoin a few heads respecting the introduction of the mariner's compass, an instrument to which we owe great

great and invaluable improvements in navigation, beyond what was possessed by men in ancient times.

The earliest navigators in their tedious voyages invariably followed the windings of the shores situated in their way; or, if at any time some more bold than the rest ventured, after long practice in coasting, to make a shorter run across the sea, thus exposing themselves in the midst of their course to lose sight for a time of the land they quitted, before they discovered that to which they were bound; in such cases their only guides were the sun, moon, and stars, in a familiar acquaintance with whose positions, risings, and settings, consisted the chief merits of the pilot. When, however, by clouds and storms these heavenly bodies were hid from their view, the most intrepid and experienced seaman was destitute of all means of ascertaining his situation, and reduced to absolute despair. Examples of this are common in ancient writings, of which it will be sufficient to point out to the student the fictitious adventures of *Æneas*, as related by *Virgil* in the 3d book of his Æneid, and the scenes immediately preceding the shipwreck of *St. Paul* on the island of Malta, presented to us in the affecting and authentic narrative of St. Luke, contained in the 27th chapter of the Acts of the Apostles.

That the magnet, loadstone, or more properly lodestone, a species of iron ore, had the property of attracting that metal, and also of communicating to it a similar property, was known in very early times. Plato, who died above 340 years before the Christian era, in his fourteenth dialogue, intituled *Io*, compares the effect produced by poetic compositions on congenial minds to the operation of the magnet or Heraclian stone, on rings of iron, which it not only attracted to itself, but endowed with a power of similar attraction, so as to act upon other iron rings in the same way as did the magnet itself, forming a connected chain of magnetised rings. Instead of making these experiments with circular

circular rings, had the antients accidentally employed long narrow bars of iron, may we not suppose that on some occasion or other, where such bars had been at liberty to move freely as on a centre, they would have placed themselves, as we now do, in the plane of the meridian, the one end pointing to the N and the other to the S, and thus the polarity of the magnet, or of a magnetised iron bar, have been discovered and applied to the purposes of life? Whatever may be in this conjecture, we have every reason to believe it was not for many ages after the days of Plato that the polarity of the needle came to be known, or at least employed for the purpose of conducting a ship across the seas.

It has been a practice with certain writers of later times to assert the claim of the Chinese to the knowledge and use of the polarity of the magnet in navigation, at a very early period, indeed nearly three thousand years ago: but to say nothing of the peculiar nature of the annals of that singular people, nor of the very suspectable channels through which our knowledge of it has in general been drawn, it may be sufficient to observe that, even at this day when the Chinese are known to be acquainted with the use of the magnetic needle, and have continually before their eyes the advantage derived from it by the European mariners who visit their shores, even at this day the Chinese make very little use of the compass, preferring a tedious winding course, within sight of land, to a shorter and more direct run from port to port, across the sea, where they have only the compass to be their guide.

The generality of writers on this subject have attributed the invention of the mariner's compass, or at least its introduction into Europe, in the beginning of the fourteenth century, to *Flavio*, or *John Gioia, Goya, Gozio, Guazzi*, &c. (for such variety occurs in his name), a native of *Amalfi*, once a celebrated port on the external shore of the lofty promontory

promontory forming the south boundary of the bay of Naples. The most, however, that may with propriety be allowed to *Gioia*, is the improvement of adapting the magnetic needle to a card, having on it lines proceeding from a centre to represent the different points of the horizon; for prior to his time it would appear the practice was to place the magnetic needle on a bit of straw floating in a vessel of water, where the needle could traverse freely, or turn round and point to the N and S parts of the horizon.

This particular we learn from the works of *Hugh de Bercy*, otherwise called *Guiot de Provins*, and *James de Vitry*, both of France, who flourished in the conclusion of the twelfth century; of whom the former, who wrote in 1181, says, "The polar star does not move: the seamen have an art which cannot deceive, by virtue of the *manete*, an ill-favoured brownish stone, to which iron spontaneously adheres. They search for the right point [of the magnet], and when they have touched a needle with it, and fixed it on a bit of straw, they lay the straw on the water, which keeps the needle afloat; then the point falls infallibly toward the star, and when the night is dark and gloomy, so that neither star nor moon is visible, the mariners set a light beside the needle, and they can be sure that the [pole] star is opposite to the point; thereby is the mariner directed in his course; and this is an art which cannot deceive."

This passage shows that the polarity of the magnetic needle, and its use in navigation were known in Europe above a century before the days of Gioia of Amalfi; but it also shews the small progress made in the employment of the needle, and that the knowledge of that polarity must have been but recent even amongst the most expert mariners of the Mediterranean.

Maps and Charts.—Were the surface of the earth a plane it would, by the use of any scale of equal parts (vol. i. p. 385), be an easy operation to lay down on paper a figure bearing

bearing to the original the same proportion that a degree, a mile, a yard, &c. on the adopted scale bears to the corresponding measures on the earth. This has been done, and in portions of the surface of the globe of small extent, the representation will not very sensibly differ from the original. From the table given in the Treatise on Geography (vol. ii. p. 22) it appears that the difference between the tenth and the first degrees of latitude, even supposing the earth to be an oblate spheroid, does not amount to one fathom or six feet, and that the difference between a degree of longitude on the equator, and one on the parallel of 10 degrees does not exceed 920 fathoms, a little more than an English mile upon an extent of 692 miles. If therefore a map or chart were constructed on such a size or scale that one degree should be represented by a space of 10 inches, consequently about seven miles by one inch, the representation on a scale of equal parts would differ from the truth, on an extent of ten degrees, only by one-seventh part of an inch; an inaccuracy scarcely perceptible on such a map or chart, and certainly of no importance in the uses to which a map or chart, on ever so large a scale, could be applied. Results nearly equal would be produced in representations of any other portion of the earth in positions much farther removed from the equator.

Plane Maps and Charts.—In constructing a map or chart of this sort a line is to be drawn at the bottom of the paper representing the lowest parallel of latitude, which is to be divided into the requisite number of equal parts corresponding to the number of degrees of longitude intended to be included in the draught. At each end of this bottom line a perpendicular is to be raised to represent the meridians, on which are set up the number of degrees (each equal to those set off on the bottom line) required to contain the given difference of latitude; a line drawn through the uppermost degree on each perpendicular, and divided simi-

larly

larly to the line at the bottom of the draught, will represent the highest parallel of latitude to be comprehended in the map.

If each of the horizontal and perpendicular lines be divided into equal parts, such as may be judged to be necessary, and through those divisions lines be drawn, the whole surface of the map or chart will be thrown into squares, by which the position of any town, promontory, island, &c. may readily be laid down. Suppose for example's sake a map or chart were constructed to contain that portion of the earth between the parallels of 30° and 40° of N. lat. and between the meridians of Greenwich, and of 10° of W. long. from that observatory. Suppose also it were required in this draught to lay down the positions of Lisbon, Cape St. Vincent, Cadiz, Gibraltar, Carthagena, &c. Lisbon being situated in N. lat. 38° 42′, and in W. long. 9° 9′ we run up the perpendicular meridians at each end of the draught to the division corresponding to the latitude 38° 42′ and laying a ruler from the one to the other, we draw a pencil line to represent the parallel of that latitude: we next look on the upper and lower horizontal lines of the draught for the divisions corresponding to the longitude 9° 9′ W. from the first meridian, and drawing a similar line, or merely laying the ruler between these divisions, we obtain an intersection with the parallel of latitude already drawn, which fixes the position of Lisbon. In the same manner the positions of Cape St. Vincent, Cadiz, &c. are laid down, and by a careful measurement and application of the dimensions all intermediate positions are ascertained.

In the same way the course of rivers, the chains of mountains, the windings of the sea coast, and every other object required to be represented, are introduced into the draught.

Mercator's or Wright's Maps or Charts.—This earth

being

being a globe or sphere, the only accurate mode of representing its surface would be by employing a globe or sphere of a certain determined magnitude, bearing a fixed proportion to the globe of the earth. The diameter of the earth being about 8000 English miles, and its circumference about 25,000, supposing a globe were made of eight feet in diameter, and consequently of about 25 feet in circumference, 1000 miles on the globe would occupy about one foot, $83\frac{1}{3}$ miles would be contained in the space of one inch, and the tenth part of an inch would include upwards of eight miles; a rate of dimensions rendering such a representation of the earth of little real utility in either geography or navigation.

This being the case with a globe of even a large diameter, the next object is to discover some method of laying down on a plane surface such a figure of the whole, or of a portion of the earth, as may admit of the application of a scale, in order to determine the relative positions, bearings, and distances of towns, &c. according to their true situations on the globe itself.

The parallels of latitude being concentric circles described about the poles as centres, and all parallel to the equator, while the planes of the meridians tend as radii to the same poles, the magnitude of a degree of longitude must continually decrease in a certain fixed proportion to the latitude where that degree is measured. This proportion it was said, in speaking of Mercator's sailing, is always as the co-sine of the latitude to radius, hence the length of a degree of longitude, which on the equator contains 60 geographical or nautical miles, will on the parallel of London be diminished to $37\frac{1}{3}$ of the same miles. If therefore a map were drawn comprehending 10 degrees of longitude, and extending from the equator to London, in N. latitude 51° 31′ the space on the equator would comprehend 600 geographic miles, while that on the parallel of London would

would contain only 373.4 miles: lines drawn through the extremities of these two dimensions would represent the meridians passing over each, and gradually approaching one another, would finally if produced, meet at the poles, consequently each must form with the equator an inward angle less than a right angle: but as it is the property of all meridians on the globe to cut the equator perpendicularly, the lines drawn in the map could not truly represent those meridians, nor would the map *in plano* be a true representation of the globular surface of the earth proposed to be shown. In some measure to remedy this defect, Mercator's or Wright's projection of maps and charts has been adopted, in which the meridians are drawn all parallel the one to the other, and consequently perpendicular to the equator; but the degrees of latitude are made to encrease in magnitude as they recede from the equator in such a manner that the length of a degree of longitude on any parallel will bear to that of a degree of latitude at that point the same proportion as such degrees actually bear to one another on the globe. Thus the extent of a degree of longitude on the parallel of London N. lat. 51° 31′ being 37.3373 geographic miles; if we state the proportion as this quantity to 60, the miles in a degree of longitude on the equator, so is the same quantity 60 to a fourth quantity, we obtain 96.42 miles. Again in the same way finding the extent of a degree of longitude on the parallel of 50° 41′ or one degree of latitude less than that of London, which will be 38.1518 miles, by the same proportion we obtain another fourth quantity 94.36 miles: adding these two quantities together and taking half the sum, (or finding an arithmetical mean between them) we have 95.39 geographical miles for the space to be contained between the parallel of latitude 50° 31′ and 51° 31′. Employing the tables of meridional parts we find the quantity correspond-

ing to 50° 31′ to be 3523, and that corresponding to 51° 31′ to be 3618; their difference 95 agreeing with the quantity discovered by the preceding operation.

In the same way may be calculated the spaces to be allowed on the map or chart between any other two parallels at any given intervals as of a degree or minute, &c. according to the size and extent of the draught, which laid down from the scale adopted for the equatorial division will mark out on the perpendicular meridian on each side of the map the points through which the several parallels of latitude must be drawn. By this mode of construction it is evident that the length of a degree of longitude on the map (on which the meridians being every where equidistant that degree occupies a space of 60 miles equal to a degree on the equator) bears to 95.39 miles, the computed distance to be allowed between the parallels of latitude 50° 31′ and 51° 31′, precisely the same proportion that 37.3373 miles, the extent of a degree of longitude on the globe at lat. 51° 31′, bears to 60 miles the extent of a degree of longitude on the equator.

It remains to be observed that however useful maps and charts on this projection may be for solving problems in navigation and geography, they afford no true representation of the surface of the earth, excepting in situations at and near the quator, where the degrees of latitude and longitude are nearly of the same magnitude; and there the difference between Mercator's and the plane chart becomes of little importance.

Various other methods have been devised and employed for representing parts or the whole of the surface of the earth: but of these it is impossible to treat satisfactorily in this place; it will be sufficient therefore to mention that maps comprehending the whole globe are constructed on one or other of the three following projections, viz. 1st. The *orthographic* or direct representation in which the surface

face of one-half of the globe is laid down as if it were viewed by an observer at an infinite distance, where the rays of sight are every where parallel to one another, and perpendicular to the points of the surface laid down. In this case, the parts about the centre of the hemisphere are shown with some accuracy, but those towards the circumference are more and more contracted as they approach the margin.

2d. The *stereographic* projection, founded on the principles of representing a solid body on a plane surface, assumes the eye to be placed on the surface of the globe, supposed to be transparent as a ball of crystal, and looking to every point of the opposite surface. In this case a contrary defect occurs, for the parts of the hemisphere situated towards the centre, are represented smaller than they ought to be, while those towards the circumference are enlarged beyond their due bounds.

3d. The *globular* projection is an attempt to combine the two former methods by choosing a point of view neither on the surface of the globe, nor at an infinite distance from it. This point of view is supposed to be removed from the surface of the globe, to a distance equal to the sine of 45 degrees of a scale, of which the radius is that of the globe itself. This position of the point of sight affords a projection in which the defects taken on a general view are the least possible, and on this account, the *globular* projection is now commonly adopted in representations of the globe of the earth.

THE

MODERN PRECEPTOR.

CHAPTER X.

DRAWING, PAINTING, ENGRAVING, &c.

A DISPOSITION to form images of eentral objeets is congenial with the human mind, evincing itself in the earliest youth and in all stages of civilization: to traee sueh images by a simple outline is properly termed *Drawing*, and the applieation of one or more eolours to eomplete the resemblance of the original object, is called *Colouring* or *Painting*.

1st. OF DRAWING.

The essenee of good drawing is to traee on paper, or other substance, a eorrect resemblance of an objeet as seen from one fixed station or point of view, observing carefully to represent eaeh part or member of the objeet or figure in the due proportionate magnitude whieh the eorresponding parts of the original bear the one to the other, and to the whole objeet taken together.

In drawing a square, a eirele, or any other geometrieal figure,

Fig. 1.

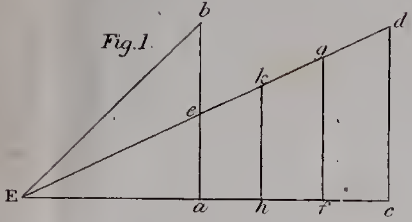


Fig. 2.

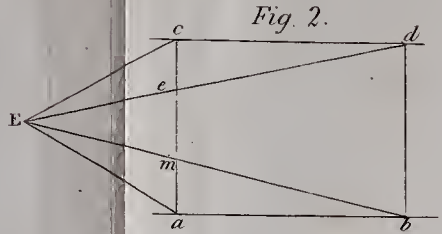


Fig. 3.

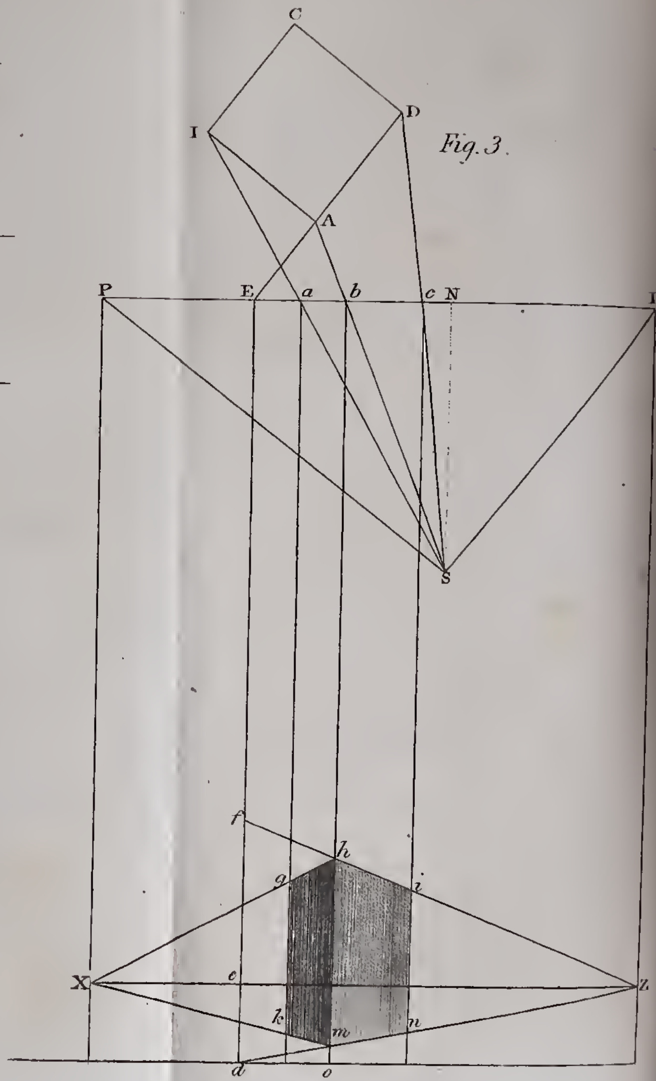
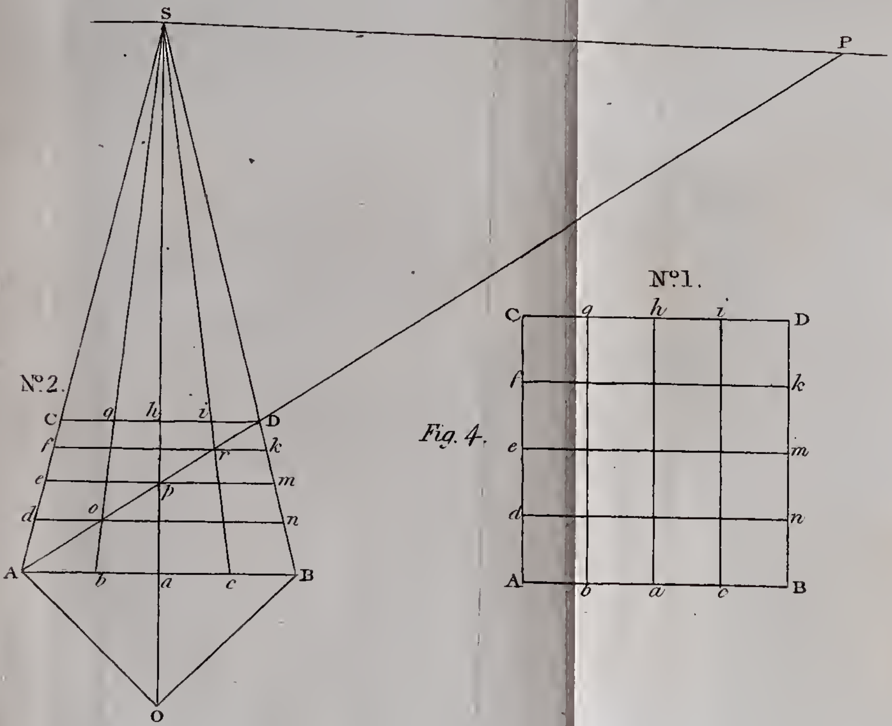


Fig. 4.



PERSPECTIVE. *Plate 2.*

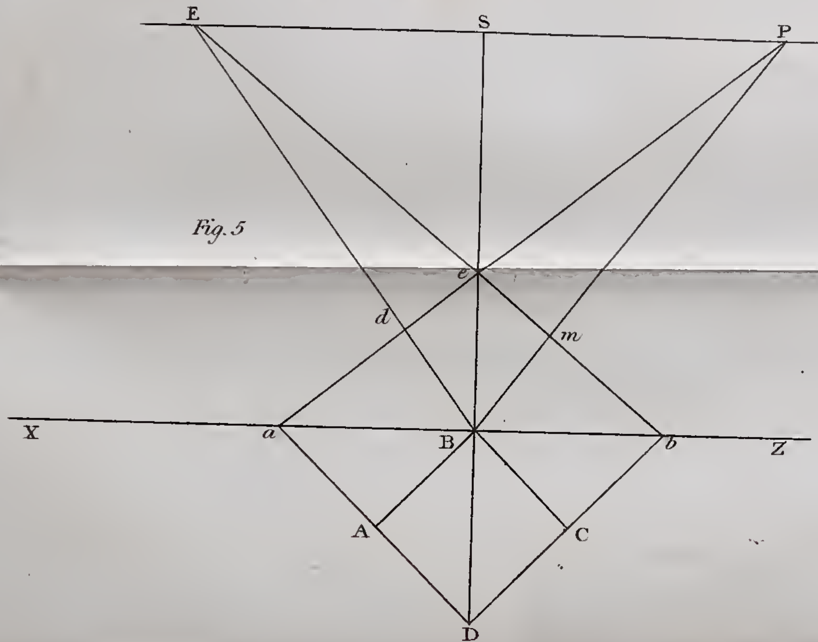


Fig. 5

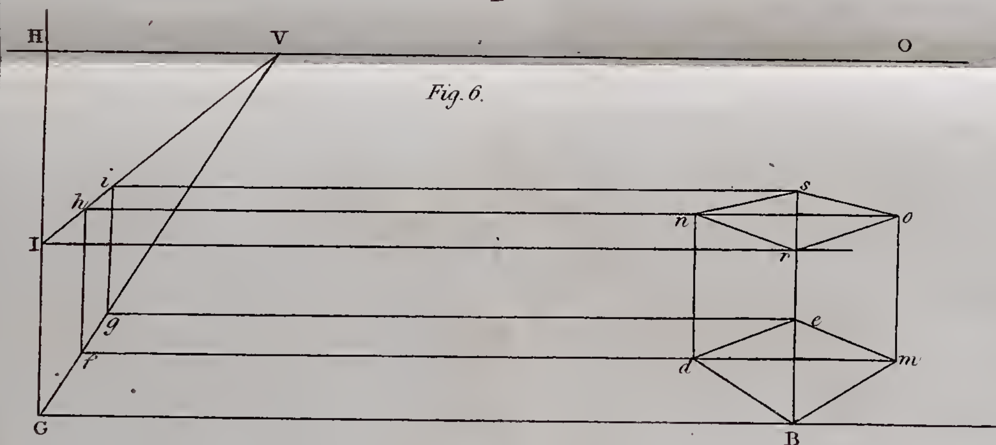


Fig. 6.

figure, this due proportion is easily preserved, because each part is measured and laid down from a determined scale: with respect to trees, houses, animals, and other similar natural objects, however, the same accuracy is not to be attained, neither if it were attainable would it be applicable; for all external objects assume very various appearances, and demand very various representations in drawing or painting, according to their position with respect to the observer, their distance, their colour, their magnitude, and many other circumstances which determine the precise manner in which they must be imitated. This precise mode of imitation, far from being vague and uncertain, is founded on principles inherent in the nature of things, susceptible of strict geometrical demonstration; and that branch of geometry by which we are enabled to ascertain such imitations is termed *Perspective.*

Perspective.—It may appear strange, but it is certainly true, that with the exception of one figure alone, we never see any object constantly as it really is. The only figure which in every possible position or point of view will always present the same appearance to the eye, is a sphere or globe, for in every attitude its outline is constantly a circle; a plane circular surface on the contrary will appear to be perfectly round only when the eye is perpendicular to its centre, or in the direction of the axis of the circle; in every other position, a circle assumes the appearance of an ellipse, until the eye come to be in the plane of its surface, when the circumference appears as a straight line.

Abstracting from all other considerations, we always judge of the magnitude of objects according to that of the angles formed in the eye by lines proceeding from their extremities, and all objects subtending equal angles at the eye, must be considered and represented as of equal magnitudes, thus in Plate fig. 1. let E be the eye of an observer, and *a b* any object within view, if lines be drawn *a*E and

and *b*E from the extremities of that object to the eye, the angle *a*E*b* will represent the magnitude of the object as judged of by the observer. Suppose another object *cd*, of exactly the same elevation with *ab*, to be situated at double the distance of the latter object, E*c* being double E*a*, then the angle formed at the eye by lines from the extremities, or *d*E*c* will be the perspective measure of the magnitude of the object *cd*: but in the similar triangles *d*E*c* and *c*E*a*, the side E*a* being one half of the side E*c*, the perpendicular *ae* will be but one half of the perpendicular *cd*, which was made equal to *ab*; consequently, *ae* will be only one half of *ab*, and the angle *a*E*e* must be only one half of the angle *a*E*b*; therefore any object as *ab*, if removed to a distance twice as great as that of its first position, will subtend an angle at the eye only one-half of that subtended at its first position. Again, the angle *a*E*e* being equal to and indeed the same with the angle *c*E*d*, the objects *ae* and *cd* will subtend equal angles, or appear to be of equal magnitudes; consequently, any given object at any distance will appear of the same magnitude with another of double its magnitude, situated at double the distance of the first object.

Hence, we discover that the several objects *fg*, *hk*, &c. although really of different magnitudes must appear to an observer at E to be all equal, because owing to their different distances, they all subtend equal angles at his eye.

Hence, also, we learn why lines strictly parallel never appear to be so; for let the two lines *ab* and *cd*, (fig. 2) represent the two parallel sides of a gallery, an avenue or the like, it is evident from the figure, that the angle *c*E*a* formed by lines from opposite points, in the end of the avenue nearest the observer at E, is much greater than the angle *d*E*b*, similarly formed by lines from opposite points, in the further end of the avenue, the nearest end appearing in breadth equal to *ca*, while the farthest appears only in breadth as em: the distance therefore between the sides of the

avenue, appearing to be unequal, the sides must appear to be inclined towards each other, with a tendency to unite at some remote point of the prospect, contrary to the essential property of parallel lines, which although produced both ways *ad infinitum*, would never approach or recede the one from the other. It is true indeed that the distance between two parallel lines must always bear a determinate proportion to their length, however extended they may be, and consequently that the angle formed at the eye, by lines from the most remote extremity, must always have a calculable magnitude: but although this be geometrically the fact, still our sight being unable beyond certain limits to perceive this subtended angle, the parallel lines may for every useful or sensible purpose be considered and represented as mutually tending to unite at some distant point.

When one stands before a mirror in a room, he observes his own figure, and part of the walls, furniture, &c. of the apartment reflected in the glass, each object in proportion to its position, magnitude, and distance, from the mirror, although reversed and apparently in another chamber to which the glass seems to present an entrance. If the observer stand sufficiently near to the mirror, and without moving from his position, trace with a pencil or otherwise on the glass, the boundaries of the various objects he sees reflected in it, the assemblage of figures thus drawn will be a correct representation (although reversed) of the several objects within his view at that point of sight. Again, if one stand at a window looking at the prospect without through a pane of the glass, and stedfastly keeping his position, draw on the surface of the glass a correct tracing of the trees, buildings, mountains, animals, ships, &c. &c. visible from his station, he will obtain a true representation of the external scenery, delineated on the plane of the glass in the window: this representation obtained by looking through the pane will be, as its name indeed

imports,

imports, a genuine *perspective* draught of the prospect before him.

By attending to these two examples, we may comprehend the nature and principles of perspective, which is in fact nothing more than the method of representing on a plane surface the appearances of objects in their due gradations of position, magnitude, and distance. This is peculiarly obvious with respect to objects reflected from a mirror; for there each evidently appears removed behind the glass, precisely to the same distance with the original object before it; as the observer approaches or recedes from the mirror, so does the reflected object proportionally approach or recede behind the glass.

Explanation of terms in Perspective.

The picture, means the paper, canvas, tablet, or other substance on which the representation of any object is drawn.

The centre of the picture, is that point where a line from the spectator's eye cuts the picture (or its plane produced if necessary) at right angles.

The distance of the picture, is the distance between the eye and the centre of the picture, or it is the length of a perpendicular, drawn from the eye to the centre of the picture. It is to be remembered, that by the centre of the picture is not meant the centre of the paper or canvas: on the contrary, these two points very seldom coincide, for the spectator is generally supposed to be situated nearer to the one side than to the other of the representation to be made, or nearer to the bottom than to the top, and in some cases the perpendicular from the eye may fall without the bounds of the representation, and consequently coincide only with its plane produced.

The point of view, is the situation of the eye of the spectator, elevated a few feet above the ground.

The

The station point, is one perpendicularly under the eye, or that on which the spectator stands.

The ground line or base of the picture, is that formed by the intersection of the plane of the picture with the horizon of the station.

The horizontal line of the picture, is that formed by the plane of the picture and a plane parallel to the horizon of the station, but passing through the spectator's eye.

The prime vertical line, is one drawn perpendicular to the ground and horizontal lines through the centre of the picture, dividing it into two equal or unequal portions, according as the centre is situated in or remote from the middle of the canvas or paper.

The vanishing point, is that in which two or more parallel lines as observed from any station would seem to meet, as was described in speaking of the appearance of the parallel sides of a gallery, avenue, &c.

The vanishing lines, are those on the plane of the picture supposed to be made by a plane passing through the eye of an observer, parallel to a plane of the original object, and produced until it touch the picture. The first and principal vanishing line is the horizontal line of the picture, which when the picture is vertical always passes through its centre.

Oblique vanishing points, are those to which all lines tend which represent original lines, situated obliquely or inclined to the plane of the picture; as these points may occur in any part of the picture, they are by old writers on perspective called *accidental points*, because they were ignorant of the rules for determining them.

Before the student attempt to draw figures in perspective, he ought to consider their several forms and their positions relative to the picture. The general forms under which most objects of art appear, are those of the square and the parallelogram for surfaces, and those of the cube and par-

allelopiped for solids. If it were required to draw a cube in perspective as standing on a plane, it must first be known whether any side is parallel or inclined, and with what angle to the plane of the picture; for there are four different positions, in which the sides or faces of a cube may be situated with respect to the picture: in the first and second positions, the cube is supposed to stand on a horizontal plane, and consequently perpendicular to that of the picture; but in the third and fourth positions, the cube stands on a plane inclined to the horizon. In the first position the cube is placed so that the nearest and farthest sides are parallel to the picture, and the other two sides with the upper and lower surfaces are all perpendicular to it. In the second position, two of the sides or faces, the upper and the lower, are perpendicular to the picture, and the other four are inclined, which is the case when the cube stands with one angle turned toward the picture, but on a plane perpendicular to that of the picture. In the third position, two sides are perpendicular to the picture, and the remaining four are inclined to both the picture and the horizon: the fourth position occurs when neither the plane on which the cube is placed nor any side is perpendicular to the plane of the picture.

Let A B C D (Fig. 3.) be the plan of a cube of 15 feet a side, situated with all its sides obliquely, with respect to an observer at S, but on the same horizontal plane: and let P I be the transparent plane through which the cube is viewed, or the picture on which it is to be represented. From S draw S N, representing the distance of the picture, of which N will be the centre. From the point of view draw S I, parallel to the side of the cube A D and S P parallel to the other side A B, meeting the plane of the picture in I and P: draw also the rays from the visible angles of the cube B S, A S, D S, cutting the picture in the points *a b c*: then will the space *a b* represent on the picture the side B A,

B A, as will the space *b c* represent the side A D of the cube.

Again through P *a b c* I draw lines perpendicular to the picture P I, and at a convenient distance draw X Z for the horizontal line passing through the eye of the spectator: continue D A, the side of the cube, until it cut the picture in E through which let fall the perpendicular E *d* making *e d* equal to the height of the eye above the ground, say 5 feet: then on the perpendicular proceeding from E set up 15 feet from *d* to *f*, for the height of the cube, and draw the lines *d* Z, f Z, which crossing the perpendiculars from *a b c* will determine the points *g h i*, *k m n*; consequently the figure *g h i n m k* will be the perspective of the given cube A B C D. The point Z will be the vanishing point of the parallel lines *h i* and *m n*, and X will be the vanishing point of the lines *h g* and *m k*: the point *d* indicates where the side of the cube D A would, if produced, cut the picture, and the space *m o* corresponds to the distance of the angle A of the cube from the picture.

To put any plane figure situated horizontally into perspective, as the square represented in fig. 4th, No. 1. where the eye is placed at right angles to the middle of a side, and the line of sight cuts the square into two equal parts.

Let A B C D, No. 1. be the given square to be drawn in perspective: draw the line A B in No. 2. similar and equal to the side of the square A B: through the middle of that line at the point *a* draw the perpendicular S O, in which O represents the eye of the spectator, and S the centre of the picture; through S draw S P the horizon line parallel to A B, making it equal to S O, then will P represent the point of distance to which the perspective must be reduced. S being the vanishing point of the sides of the square A C and B D, draw the lines A S and B S; draw also the line A P cutting B S in D, and C D parallel to A B and S P,

when

when the perspective of the square will be completed in the figure A C D B of No. 2.

If the given square were supposed to be divided into any number of other squares, as into sixteen, by the cross lines *f k e m*, &c.; divide the side of the perspective figure A B into four equal parts in the points *b a c*, from which draw lines to S, the point of sight in the picture, crossing the line A P or the diagonal AD, in the points *o p r*, through which drawing *f k*, *e m*, *d n*, parallel to A B or C D, the perspective will be divided into sixteen figures, varying in position and magnitude according to their several situations with respect to the observer at O; but each figure presenting the true perspective representation of its corresponding little square contained in the given great square A C D B No. 1.

If it be required to place in perspective a square situated with its diagonal perpendicular to the plane of representation or of the picture, consequently with its sides inclining to that plane in an angle of 45°; let A B C D (fig. 5) be such a square, S be the point of sight, E and F equidistant from S the points of distance. Draw the line X Z, touching the angle of the given square at B perpendicular to the diagonal B D and parallel to E S F: produce the sides of the square D A to *a* and D C to *b*: join *a* F, B F, and B E, *b* E, intersecting the former lines in *d m* and the line of sight B S in *e*: then will the figure B *d e m* be the perspective plan of the given square A B C D.

Again, to put any solid figure into perspective, we begin by first projecting its plan: let it be required to throw into perspective a cube standing on a square such as that just described, having its diagonal perpendicular to the plane of the picture, and the eye of the observer elevated above the level of the upper surface of the cube, as in fig. 6th, where B *d e m* is the perspective representation of the square base of the cube, having B *e* the diagonal perpendicular to the ground line G B. At any convenient distance from the square at

at G erect the perpendicular G H, and through H draw H O to represent the horizon line passing through the observer's eye. On G H set off G I equal to the side or the altitude of the cube; and assuming any point V in the horizon line H O join V I and V G. Then through the angles of the projected square *d e m* draw *m d f* and *e g*, meeting V G in *f* and *g*: on these points erect perpendiculars meeting V I in the points *b i*, through which draw lines parallel to the ground and horizon lines, meeting perpendiculars erected on the angles of the projected square in the points *r n s o*; next joining *r n*, *n s*, *s o*, and *o r*, the required perspective of the given cube is obtained; B *d e m* representing the base, B *r o m* one perpendicular face, B *r n d* another perpendicular face, and *r n s o* the upper horizontal surface.

Circles, ellipses, and other curvilinear figures are thrown into perspective by inclosing them in or dividing them into right lined squares, parallelograms, &c. of which the perspectives being drawn, the curves may be traced by the hand, observing the points in the original figures through which they pass.

Were we to judge from the practice of many modern artists the study of perspective might appear to be unnecessary, some committing in their productions errors of no small importance to the effect of their works, which however are the less frequently discovered, that by far the greater body of their admirers are themselves ignorant of the first principles of the science.

Drawing.

Materials used in drawing.—These are black lead pencils, crayons of different colours, crow quills, compasses, scales and rulers, camel's hair pencils, Indian or China ink, Indian rubber. The beginner must hold the pencil farther from the point than he does a pen in writing, by which practice he will acquire greater freedom and command in the use of it.

The

The pencil is employed to draw the first sketches or outlines of the piece; for any wrong stroke or line may be effaced by means of the Indian rubber *. When the sketch is thus made and corrected, the outline is drawn with Indian or China ink, and the pencil tracings are removed by the rubber or crumbs of stale bread. When the outline is thus finished, the next thing is to shade the piece, as will be hereafter shown, either by drawing fine strokes with the pen, or by washing it with different tints of Indian ink.

Drawing lines, circles, and other geometrical figures.

The necessary implements being provided, the first step is to practice the drawing of straight and curved lines with freedom in all directions. From this the beginner proceeds to form squares, circles, ellipses, or ovals with the hand alone, without the use of scale or compasses: for it is always to be remembered that geometry is to drawing exactly what the letters are to reading. In these exercises it is proper to caution the student to work slowly and deliberately, until he has acquired a certain command of his pencil, when he may begin to work with greater rapidity. He must never proceed to a more difficult figure until he be perfectly master of the more simple figures of which the complicated are composed. The pupil should also accustom himself to draw his figures on a large scale, in order to arrive at a free and bold manner of designing; and continue the practice

* The substance called Indian rubber or elastic gum is named *caoochooc* by the natives of Cayenne, on the north coast of South America, where it is chiefly found. It is the produce of what is called the Syringe tree, oozing out in the form of a vegetable milk from incisions made in the trunk or branches; it flows most abundantly in time of rain. This gum is applied by the natives to various purposes of utility in life: the *bottles* we see made of it are produced by repeated layers or coats of milk over balls of clay, which there dry, and being held over a strong smoke of vegetables assume the colour and consistency of leather, when the inside substance is picked out.

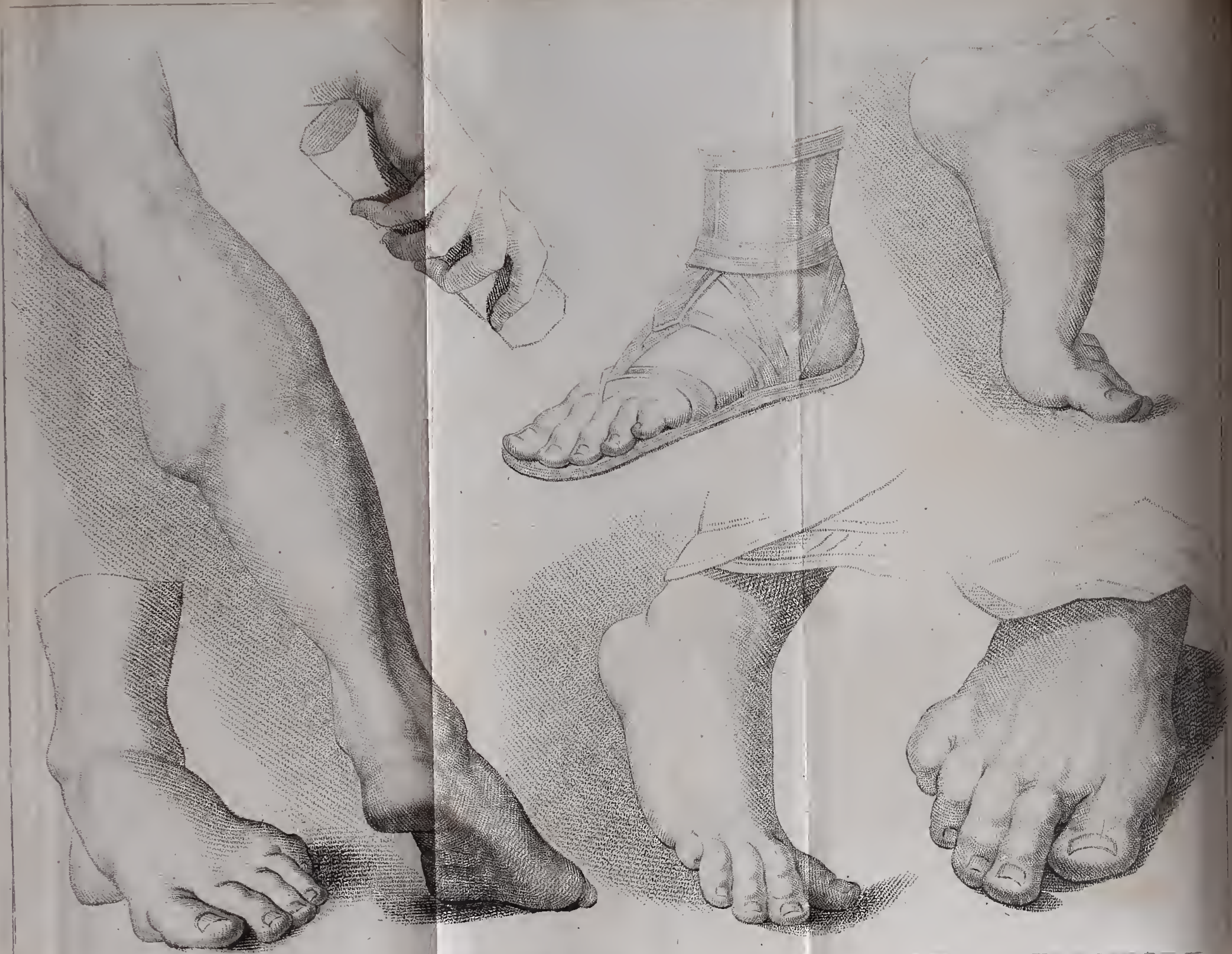
of

Pla

London; Published by Vernor, Hood & Sharpe, Poultry, Feb. 1. 1810.

Plate 1

London; Published by Vernor, Hood & Sharpe, Poultry, Feb.1.1810.



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of outline for a considerable time before he attempt to fill up and shade his figures.

Drawing eyes, ears, arms, heads, &c.—In this branch of drawing the pupil must copy the best lessons, of which a great variety are given in this and other works more particularly adapted for instruction in drawing. No certain rules can be given for representing the endless diversity of forms, postures, and actions of the members of the human body; but as the power of expressing them in various circumstances is to a draughtsman indispensable, he must by constant practice become acquainted with their various appearances in every possible change of position or shape. One general rule however may be given, applicable indeed, not only to this but to every other species of drawing, which is that one feature, limb, or other part of a figure ought not to be shaded and finished until the whole design has been sketched out; because deformities and incongruities in any part will be most perceptible when examined in comparison with the other parts of which the whole figure consists. The pupil will therefore sketch out faintly the shape of the head, hand, &c. with its action and attitude, and after considering whether this sketch be correct, he will proceed to insert the other features, joints, veins, and other particulars.

Drawing faces.—The human head is usually divided into four equal parts; 1. from the crown to the top of the forehead, 2. from thence to the eye-brows, 3. from the eye-brows to the bottom of the nose, and 4. from the nose to the bottom of the chin. This proportion, however, is subject to variation in different figures; but in a well-proportioned face it is tolerably accurate. In forming a perfect face, the first step is to draw an oval divided equally from top to bottom by a perpendicular line: across the middle of this draw another line at right angles; on these two lines all the features are to be arranged thus; divide the perpendicular line into four equal parts, allotting the uppermost

to

to the hair of the head; the second contains all between the hair and the top of the nose, between the eyebrows, the third from thence to the bottom of the nose, and the fourth contains the mouth and chin. The cross line or breadth of the face is supposed to be equal to five times the length of an eye: it is therefore divided into five equal parts, the middle part being allotted to the distance across the nose between the eyes, the two adjoining spaces, to the eyes themselves, and the two outward spaces to the parts on the outside of each eye. This is the mode of drawing a full face; but if it be turned to either side, or looking upwards or downwards, the distribution of the features must vary according to the degree of inclination from the direct full face. The top of the ear is made level with the eyebrows, and the bottom with that of the nose: the nostrils should come out no farther than the corner of the eye; and the middle of the mouth must always be placed on the perpendicular line of the face.

Human figures.—Having learned to form the head, produce the perpendicular line of the face downwards to a distance equal to six times the height of the head, which will give the measure of the whole figure; for the head in well proportioned figures is one-seventh part of the whole height, although to judge from the best statues now remaining, it appears that the antients allowed to their figures 7¾ heads: but those statues are representations of highly embellished nature adapted to divinities and heroes, in which a small head being considered as a mark of strength and beauty, the sculptor may have adopted a proportion different from that of the living models around him. When the figure stands erect upon both feet, the body is precisely one half of the height, and the legs the other half, and the middle of this lower half is the centre of the knee. In measuring the upper part of the figure, a different scale is adopted, viz. that of the length of the face, which as was before observed is three-fourths of the head. The length of the body

body below the chin is equal to three faces, and the legs contain four faces. From the top of the shoulder to the elbow is usually reckoned $1\frac{1}{2}$ head; from the elbow to the hand $1\frac{1}{4}$ head, the length of the hand to the tip of the middle finger is about $\frac{5}{8}$ of a head: but the correct measurements of the human body, the positions and effects produced by the motion of the various bones and muscles, can only be learned by a careful study of the best works on anatomy, assisted by attentive inspection of the natural subject.

In drawing the human figure it is advisable to begin with the head and working downwards to sketch in the shoulders, leaving the arms to be afterwards annexed; next proceed to the body and the legs, drawing first that on which the figure rests.

If a strong person is to be represented in vigorous action, such as Hercules, Samson, &c. after a suitable proportioned figure is designed, the parts or limbs chiefly concerned in the action are to be considered. If the figure be standing the foot must be placed in a right line, or perpendicularly under the trunk of the body, where the weight of the whole may be equally balanced, which in this case would be in the heel; but if the figure stand upon tiptoe, the centre of gravity would be thrown forward to the ball of the great toe. The muscles of the leg supporting the body ought to be swelled out, and their tendons drawn more to extension than those of the other leg which is so placed as to receive the weight of the body towards that part whither the exertion inclines it. For example, suppose Hercules striking with a club something before him towards his left side: then let the right leg be placed so as to receive the whole weight of the body, and the left loosely touching the ground with the toes. Here the external muscles of the right leg must be strongly expressed, but those of the left scarcely appearing more than if the figure were seated. The foot being ex-

tended, the muscles which compose the calf of the leg are exerted, and are strongly expressed; though it is not meant that *all* the muscles of the right leg are to be strongly expressed, or equally swelled, but those only which are chiefly concerned in the action or posture of the limb; thus if the leg or tibia be extended, then the extending muscles of the thigh are most swelled; if it be bended, then the bending muscles and tendons are most prominent. It is also to be observed that from the difference in the structure of their bodies, neither the bones nor the muscles are so prominent in women as in men, even when similar exertions are made by each sex.

Of light and shade.—When the pupil is in some measure master of drawing a correct outline, he will begin to finish his work by shading. It is this which gives an appearance of substance, shape, distinctness to whatever subject is meant to be represented, whether animate or inanimate. In the first place the beginner is to consider from what point and in what distinction the light falls upon the object he delineates, in order that all the lights and shades may appear to proceed from that point, and in that direction. That part of an object must appear the lighest which has the light most directly opposite to it; if the light fall sideways on the object, the side opposite to it must be the lightest, and the side farthest from the light must be the darkest. If you draw a human figure with the light proceeding directly from above; then the top of the head will be the lightest, the shoulders a little darker, and the lower parts of the body gradually darker as they recede from the light. Those parts of objects, whether figures, drapery, buildings, which stand farthest out, must be made the lightest, because they come nearest to the light; and the light loses so much of its brightness in proportion as any parts of the figure bend in. It was a saying of Titian, the great ornament of the Venetian school of painting, that no

better

better rule could be followed for distributing lights and shades than to observe the effects of the sun's rays upon a bunch of grapes. Satins, silks, and some other shining stuffs, have certain glancing reflections, exceedingly brilliant, where the light falls strongest : similar effects are produced in antient armour, vessels of brass, or other shining metal, where you may see a sudden brightness in the middle of the light which discovers the brilliant nature of such objects. A strong light demands always a proportionally strong shade; a fainter light demands a fainter shade, so that a due balance may be preserved through the whole piece. Those parts of objects which are to appear round require but a very faint shade, but such as are to appear hollow or steep, demand a very dark shade. In all places where the light is strong the outline of the figure ought to be very faint and delicate; but in the dark shades the outline may be strong and broad. As objects appear with more or less distinctness in proportion as they are nearer to, or farther from the spectator, so in a drawing the due gradation of light and shade ought to be observed; thus if a small figure be represented with strong light and shades, we will be apt to conclude that the original object is really small, and situated at no great distance from the eye, whereas if the object had been shown with a certain degree of indistinctness, such as we observe distant objects really to assume in nature, we would understand it to be far removed from the spectator.

Drapery.—In clothing figures, or throwing the drapery around them, there are several things to be considered. 1. The eye must never be in doubt of the object, but the shape and proportion of the part or limb supposed to be covered by the drapery must still be perceptible, as far as probability will allow; to secure this point, some artists have made it a practice first to sketch the figure itself, and next to apply the drapery to it. 2. The drapery must not sit

sit too closely to the body, but seem to flow round it so as to leave the figure an air of easy free motion. 3. The drapery in those parts most exposed to the light must not be shaded so dark as that on parts removed from the light: nor should the enlightened parts of the body be crossed by deep dark folds of the drapery, which would have the appearance as if the folds entered into the substance of the body itself. 4. The great folds should be first drawn, and then broken into less folds, observing always that they do not cross one another in an unnatural manner. 5. In general folds should be as large as possible, and few in number: adapting them however to the nature of the stuff of which the drapery consists, and also to the rank and condition of the persons meant to be represented: if they are magistrates or philosophers, the drapery ought to be large and ample; if peasants or slaves, coarse and short; if ladies or nymphs, light, soft, and airy. 6. The drapery must be suited to the body, bending with it according as the limbs project or retire; and the closer the garments fit the body, the smaller and narrower must be the folds. 7. Folds properly distributed give much spirit to action, because their motion seems to be produced by the motion of the limb or body. 8. A skilful complication of folds aids greatly the effect of foreshortening any object. 9. All folds consist of two shades only, which may be turned at pleasure with the garment, shading the inside deepest and the outside more faintly. 10. Shades of fine linen or silk are very small and thick, requiring little folds and light shades. 11. The motion of the air or wind is to be observed, in order to draw all the looser apparel flowing the same way; and that part which adheres to the body must be drawn before the loose floating parts. 12. Rich ornaments when judiciously employed may contribute much to the beauty of draperies: but such ornaments are quite unsuitable to the dignity of divinities, angels, or heavenly figures, the grandeur of whose

draperies

draperies ought rather to consist in the bold and noble simplicity of the folds than in the richness of the stuff or the glitter of ornaments. 13. Light flying drapery is suited only to figures in the wind or in rapid motion; but in a calm place and free from violent action, the drapery should be large, easy, and flowing, that by their contrast and the fall of the folds they may appear with more grace and dignity.

The Passions.—The passions are, to use customary language, motions of the soul, either upon her pursuing what she judges to be for her good, or upon shunning what she thinks may be hurtful; and whatever causes any emotion of passion in the mind is usually accompanied by a corresponding action in the body. It is, therefore, impossible to be a painter without knowing what are the various actions and appearances of the body, indicative of the several passions of the soul, and how to delineate them: the following short account of the passions drawn from the writings of Dr. Watts must, therefore, be useful to the young artist.

"An object which is suited to excite the passions must have one of these three properties, viz, it must be either 1, rare and uncommon; or 2, good and agreeable: or 3, evil and disagreeable; or at least we must have some such ideas and apprehensions of it before it can excite any passion in us. Now if we will distinguish the chief passions of our nature according to their objects, and confine ourselves to the common words and names whereby they are usually called, we may make three ranks of them, which for distinction's sake I shall name the first, second, and third rank. The first two are primitive, the third is derivative.

The first rank of passions contains these three, admiration, love, hatred: if the object be rare, and uncommon, it excites admiration or wonder; if we look on it as good or any way agreeable to us, it may engage our love; but if it be evil or disagreeable, it moves our hatred.

"The

"The second rank of chief passions comprehends the divers kinds of love and hatred, which are also distinguished by their objects. If the object appear valuable, it raises a love which we call esteem; if worthless, the hatred is called contempt; if the object appear fit to receive good from us, it is the love of benevolence or good-will; if it rather appear fit to receive evil from us, the hatred is called malevolence or ill-will.

"If the object appear pleasing and fit to do us good, it raises the love of complacence or delight; if it be displeasing and unfit to do us good, it unites displacence or dislike.

"From love and hatred in their different kinds, but chiefly from complacence and dislike, arise several other chief passions which may be ranged in the third rank, and which are also distinguished by their objects.

"In love and hatred, and in all the passions of the third rank which are chiefly derived from them, the pleasing object is more properly called good, and the displeasing object is more properly called evil, than in the passions before-mentioned.

"If the good be absent or unpossessed, and possible to be obtained, the passion of love grows up to desire: if the evil may possibly come upon us, the hatred expresses itself in aversion or avoidance. There may, however, also be an aversion to some evil from which we are sufficiently secure.

"If there be any prospect of obtaining the absent good, the passion excited is hope; but if the absent evil be likely to come upon us, it raises the passion of fear. Fear also arises from a present or expected good in danger of being lost; and there is a hope of security from some absent threatening evil, or of deliverance from some evil that is present.

"If the good be actually obtained, or the evil prevented, it excites joy and gladness; if the good be actually lost, or the evil come upon us, it causes sorrow or grief.

"Whoever

"Whoever helps us to attain this good, or prevents the evil, excites our gratitude; whoever hinders our attainment of good, or promotes the evil, raises our anger.

"There are few, if any, of the passions for which we have any name, and which are usually noticed in the heart of man, but what may be reduced to some one or other of these general heads."

It would be absurd as well as impossible to offer such particular demonstrations of the passions as to fix their expression to certain strokes of the pencil, to be followed by the artist as essential and invariable rules. This would deprive the art of drawing and painting of that beautiful variety of expression which is founded in the infinite diversity of imagination; for the same passion may be represented in different ways, each yielding more or less pleasure in proportion to the understanding of the painter, and the discernment of the spectator.

Though every part of the face contributes towards expressing the sentiments of the heart, yet the eye-brow is generally reckoned the principle seat of expression, where the passions make themselves best known. The pupil of the eye, it is true, by its fire and motion, very well shows the agitation of the mind; but then it does not express the kind or nature of such an agitation; whereas the motion of the eyebrow differs according as the passions change their nature. To express a simple passion the motion is simple, to express a mixed passion the motion is compound; if the passion be gentle, the motion is gentle; if it be violent, so is the motion. There are also two kinds of elevation in the eye-brows; one in which they rise up in the middle, expressing agreeable sensations, when it is to be observed that the mouth also rises up in the corners; another in which the eye-brows rise up at the ends, and fall in the middle, denoting bodily pain, and then the mouth falls at the corners. In laughter all the parts agree, for the eye-brows which fall

 toward

toward the middle of the forehead make the nose, mouth, and eyes follow the same motion. In weeping the motions are compound and contrary, for the eye-brows fall toward the nose and over the eyes, while the mouth rises that way. It is also to be observed that the mouth is the part of the face which most particularly expresses emotions of the heart; for when the heart complains the mouth falls at the corners; when it is at ease the corners are elevated; and when the heart has an aversion, the mouth shoots forward and rises in the middle.

The head, it has been observed, contributes more to the expression of the passions, than all the other parts of the body put together; those separately can only show some few passions, but the head expresses them all. Some, however, are more peculiarly expressed by the head than others, as humility by hanging it down, annoyance by lifting it up, languishment by inclining it to one side, obstinacy when with a stiff and resolute air it stands upright, fixed immovable between the shoulders. The head also best shows our supplications, threats, mildness, pride, love, hatred, joy, and grief. The whole face and every feature contributes something to expression, especially the eyes, which as *Cicero* says, are the windows of the soul. The passions they more particularly discover are pleasure, languishing, scorn, severity, mildness, admiration, and anger; to which might be added joy and grief, if they did not proceed more particularly from the eye-brows and mouth; but when these two passions fall in also with the language of the eyes, the harmony of expression is admirable. But though the passions of the soul are most visible in the lines and features of the face, they often require the assistance of the other parts of the body. Without the hands for instance all action is weak and imperfect; their motions create numberless expressions; it is by them we desire, hope, promise, call, send back; they are the instruments of threatening, prayer, horror,

horror, praise; by them we approve, condemn, refuse, admit, fear, ask, express our joy and grief, our doubts, regrets, pain, admiration. In a word it may be said, as the hands are the organs of speech to the dumb, that they contribute not a little to speak a language intelligible to all nations, which is that of painting.

Flowers, fruits, birds, beasts.—In drawing objects of this description few directions can be given; the proper course for the pupil to follow being to copy carefully the best prints or drawings he can procure. In drawing the figure of a horse, for example, he should begin with the forehead and draw the nose, the upper and under jaws, and stop at the throat; then he will go to the top of the head and form the ears, neck, back, and continue the line until the body be completed; next are to be drawn the breast, legs, and feet; and last of all the figure is finished with the proper shading. To render the representation complete, a small sketch of landscape or scenery should be added, suited to the place or country of the animal represented.

Landskapes, Buildings, &c.—Of all the branches of drawing this is the most useful and entertaining, as it is what every person may have occasion to execute at one time or another in the course of his life. To be able on the spot to take the sketch of a fine building, or a beautiful prospect, of any curious production of art, or uncommon appearance of nature, is not only a very desirable accomplishment, but a very agreeable amusement. Rocks, mountains, fields, woods, rivers, cataracts, cities, towns, castles, houses, fortifications, ruins, machinery, or whatever else may present itself to view on a journey, or in travels, by sea or land, at home or in foreign countries, may thus be brought home and preserved for future use, either in business or conversation: on this branch of art therefore the pupil ought to bestow more than ordinary pains.

In representing a building the pupil is, 1. to begin with the

the right side, that the hand may not hide any part in the operation: 2. after drawing the outline, the windows, doors, niches, &c. are to be sketched: 3. sometimes it is necessary to draw vertical and horizontal lines to represent the divisions of the bricks or stones in the wall; the horizontal lines are carried across the whole breadth of the building, but the vertical extend only from one horizontal to another: 4. in shading the walls, if they be of stone that part which is exposed to the light reflects it very strongly, and should therefore have little or no shade.

In landscape the student must be particularly attentive to the distances of objects, upon which the beauty of the piece chiefly depends: he must habituate himself to judge of distances and measure them by the eye, especially in sketching from nature, where no artificial helps can be applied. He should, in copying from nature, choose his station on some gentle elevation where he may have a wide view and an extended horizon: he must next divide his paper or drawing board into three equal divisions from the top to the bottom, and also into a convenient number of equal divisions from the one side to the other; dividing in his mind the prospect before him into similar portions. Then let him lay down upon the middle division those objects immediately before him, next those towards his left hand, and lastly those towards his right; observing that he change not the situation of his body, nor move from his place until the whole draught be finished.

Many varieties of opinion have been given as to the extent of view from right to left, which ought to enter into a landscape: the necessity of turning the head in taking a view should be avoided; for a view should comprise no greater extent than the eye can conveniently contemplate at one *coup d'œil* or glance of the eye. To fix upon the angle of view, that is the angle formed at the eye of the spectator by rays proceeding from both extremities of the prospect, is perhaps

perhaps impossible, different subjects requiring different manners of representation. Some writers on perspective and drawing have laid it down as a rule that the extent of the picture should never exceed the distance of the eye from the picture, so that the triangle formed by the picture and the rays from each extremity meeting at the eye would be isosceles, having its base equal to its perpendicular altitude, in which case the angle of view at the eye would be $63\frac{1}{2}$ degrees: other authors prefer a smaller angle down to 45 degrees: and probably these two quantities may be considered as the limits of the angle of view.

It was observed in speaking of perspective that objects subtend a greater or less angle at the eye in proportion to their distance from the spectator: hence it becomes necessary that in a landscape the nearest objects should, *cæteris paribus*, be represented the highest, and the more remote gradually lowering proportionably to their distance. Objects must also be shown less and less distinct as they recede from the eye, so that the most distant mountains or other objects will seem to be blended with the surrounding sky. Lights and shades must all fall in the same way, and objects moved by the wind, as ships, trees, must show its effects as proceeding from the same point of the heavens; in trees the slender branches must bend more than the strong arms or the trunk, and tall young saplings more than aged sturdy oaks. In representing the sky the nearest clouds must be placed towards the top of the picture, as if over the spectator's head, and be more strongly marked and shaded than those more remote; and the farther the clouds are removed from the observer the lower must be their situation in the picture, the fainter must be their shades, until they mingle with the horizon where they become invisible.

Water in drawing assumes very different appearances: when calm and still it strongly reflects the light, and therefore has little or no shade, which to preserve the contrast is

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reserved for the objects inclosing its margin: when violently agitated it is to have some very deep broken shades in imitation of waves; and other parts dashing against rocks, ships, or other objects, have a shade contrasted of black and white, to represent the foam produced by the agitation.

PAINTING—He who imagines the whole art of painting to consist in the dextrous management of colours, and of light and shade, has formed a very imperfect notion of the art. The success of some men who have risen to eminence, although in a great measure unacquainted with the other parts of painting, by no means warrants hasty unqualified attempts on the part of the beginner. The painter ought in some sense to be well informed in many of the most important branches of knowledge: but the following are indispensable, viz. *anatomy*, *perspective*, *sacred*, *civil*, *and fabulous history*, *and a careful observation of the different appearances of objects as they appear in their natural state.* To insist upon the necessity of an accurate study of *anatomy* would be superfluous; the authority and the example of the greatest masters are sufficient to enforce the prosecution of this subject. He who is unacquainted with the forms and positions of the several bones which support and govern the human form, and who knows not the situations and offices of the several muscles by which the bones are moved, will never be able accurately to describe or represent the various appearances produced on the surface of the body by their motions; in delineating which, however, consists a main part of the painter's art. *Perspective* claims an equal share of attention with anatomy; the latter enables the artist to express the human body in all situations and circumstances; the former teaches him to give objects their respective outlines according to their relative situations respecting the observer and each other: for the outline of any object drawn upon a plain surface is nothing more than such an intersection of the visual rays proceeding from the extremities of the object

object to the eye, as would appear on a plate of glass put in the place of the canvass or paper upon which the object is to be drawn; the surface of the painting may therefore be considered as nothing more than a glass through which we discover the natural object on the opposite side. Hence the situation of an object beyond the glass or plane of representation being given, its figure on the glass depends entirely on the situation of the observer before that plane, that is to say, on the rules of perspective. The theory of perspective being only an application of certain geometrical principles, an acquaintance with *geometry* becomes indispensable to the artist who would found his theory on sure and certain grounds. *Optics*, or the theory of vision, light, and colours, must appear to be absolutely requisite to instruct the painter in determining the degree in which his objects are to be illuminated or darkened, in order to imitate the natural original; by this study he will learn the proper method of throwing his shadows, and acquire an insight into what, in the technical language of the art, is termed *chiaro oscuro*, Italian words, signifying light and dark. In studying nature, as exhibited in the objects around him, the young painter must not imagine he should adopt a servile manner of copying them: for painting is not only to be considered as an imitation producing deception or illusion in the mind of the spectator, but in many respects as offering an image rather of what ought to be than what is the precise appearance of any individual object. The image must therefore contain nothing discordant with or contrary to what is observed in nature, but it must at the same time exhibit a judicious and tasteful selection of the most agreeable parts of natural objects. In giving a general representation of the human figure, no painter would think of representing a man or woman in sickness, deformity, or the decrepitude of old age; on the contrary, he would if possible introduce into his composition the most agreeable and dignified ideas compatible with

with the human form: for his men the Apollo of Belvedere, and for his women the Venus of Medicis would be the models. It is not enough for the painter that the object he presents may contain nothing but what may actually be found in nature: his business, and there he gives proofs of his learning, genius, and taste, is to furnish the best choice and selection of natural objects.

Imitation.—In painting the leading principle is imitation: for this purpose the artist should never be without his portfolio or memorandum book, and crayons. Every fine building, every new effect of the light, every fresh arrangement of the clouds, every various flow of drapery, every graceful or dignified attitude or gesture,—these and the like ought to be instantly and accurately recorded. Such sketches will not only furnish him with objects and scenes for his work, but by acquiring the habit of observation, he will be enabled to select the most beautiful and sublime parts of natural objects, and by arranging them to form one whole in his picture, will have opportunities of trying and improving his taste.—On the subject of imitation the pupil will do well to attend to the following observations of a distinguished artist of modern times:

"The addition of other men's judgment is so far from weakening our own, that it will fashion and consolidate these ideas of excellence which lay in their birth feeble and confused, but which are finished and put in order by the authority and practice of those whose works may be said to have been consecrated, by having stood the test of ages.

"When we speak of the habitual imitation and continued study of nature, it is not to be understood that we are to endeavour to copy the exact colour and complexion of another man's mind: the success of such an attempt must always be like his who imitates exactly the air, manner, and gestures of the person whom he admires: his model may be excellent, but he himself will be ridiculous; and this

this ridicule arises not from his having imitated another, but from his not having shown the right mode of imitation.

"It is a necessary and a warrantable pride to disdain to walk servilely behind any individual, however elevated his rank. The true and liberal ground of imitation is an open field where, though he that precedes has had the advantage of starting before you, yet it is enough to pursue his course; you need not tread in his foot-steps, and you certainly have a right to outstrip him if you can.

"Nor whilst I recommend studying the art from artists, can I be supposed to mean that nature is to be neglected: I take this study in aid, and not in exclusion of the other. Nature is and must be the fountain which alone is inexhaustible, and from which all excellencies must originally flow.

"The great use of studying our predecessors is to open the mind, to shorten our labour, to give us the result of the selections made by those minds, of what is grand or beautiful in nature; her rich stores are all spread out before us; but it is an art, and no easy art, to know what to choose, and how to attain and secure the objects of our choice. Thus the highest beauty of form must be taken from nature: but it is an art of long duration and great experience to know how to find it.

"I can not avoid here mentioning an error into which young artists are apt to fall: he that is forming himself must look with great caution and wariness on those peculiarities or prominent parts which at first force themselves on his view, and are the marks, or what is commonly called the manner, by which any individual artist is distinguished. Peculiar marks I hold to be generally, if not always, defects, however difficult it may be wholely to escape them. Peculiarities in the works of art are like those in the human figure; it is by them we are distinguished the one from the other: but they are always so many blemishes

blemishes which however, both in the one case and in the other, cease to appear deformities to those who have them continually before their eyes. In the works of art, even the most enlightened mind, when warmed by beauties of the highest kind, will by degrees find a repugnance to acknowledge any defects; nay, his enthusiasm will carry him so far as to transform them into beauties and objects of imitation. It must be acknowledged that a peculiarity of style, either from its novelty or by seeming to proceed from a peculiar turn of mind, often escapes blame; on the contrary, it is sometimes striking and pleasing, but it is vain labour to endeavour to imitate it; because novelty and peculiarity being its only merit, when it ceases to be new it ceases to be of value. A *manner* therefore being in general a defect, and every painter however excellent having a manner, it seems to follow that all kinds of faults, as well as beauties, may be learned under the direction of the greatest authorities."

Colouring.—Though colouring properly belongs to the mechanical part of painting, and is undoubtedly an inferior qualification, yet as it is colouring alone which peculiarly distinguishes painting from the other imitative arts, it particularly deserves the student's attention. Composition, imitation, design, expression, are common to other arts; but colouring is in a great measure the principal foundation on which painting rests, for its powers of imitation. Colours affect the observer according to their resemblance to those of the natural object represented; the more therefore they approach to natural colours, the more successful is the illusion they are intended to produce.

To understand colouring, the student should make himself acquainted with optics, or the theory of light and colours: otherwise he will never be able to account for many appearances observable in the examination of different combinations of tints. In the pursuit of this study, he will find that

that light, simple as it appears to the eye, is compounded of various shades, as for example, of red, orange, yellow, green, light blue, dark blue, violet.

In colouring, the chief objects may be ranged under the heads, *truth, force, keeping, harmony.* By truth in colouring is meant that every object should receive that tint which in the circumstances in which it is represented it naturally possesses. By force is intended the arrangement and management of the several objects, so as to produce the most powerful and intelligible effect. In this case the principal objects of the piece are to be brought forward, placed in a conspicuous situation, displayed to advantage by vigorous colouring, and properly contrasted: force owes much to a judicious management of light and shade. By keeping is understood the representation of objects in the manner in which they appear to the eye at different distances from it: and for this purpose the artist must call in the aid of perspective. Harmony is produced by a judicious selection, systematic arrangement, and natural situation of colours, only to be acquired by diligent attention to the works of both nature and art.

The general principles of colouring are nearly the same in whatever subject the painter undertakes to represent; for example, if the effect of a piece be required to fall in the centre of the picture, as is generally the case, this part must be the place of the hero, or other principal object; here also must be the strongest light and shade, the most vivid colours, the greatest force, the greatest resemblance of nature; in a word, in this point are assembled all that can tend to make the figure conspicuous. It may be considered as the focus of a lens, where all the rays unite with the greatest force, and from which, as they diverge towards the extremities of the picture, they gradually weaken until they are in a manner lost in the ground of the piece; the lights, colours, and expression regularly declining in power accord-

ing to their distances from the centre, and their approach to the boundaries of the work. It is not however to be understood that this declension of light and colour should so uniformly prevail as to admit of no exception; on the contrary, the principal light should always be made to catch on some adjacent objects, where it suddenly revives and shines, but still in subordination to the light of the principal object: the same is to be observed of the principal colour of the picture, which, on many surrounding objects, often shines with a refulgence nearly equal to that of the principal subject of the picture.

To produce effect in colouring, the beginner must labour to become acquainted with the nature of colouring substances, of the tints they produce, considered as they are warm, or mellow, and cold, as they have a sympathy or antipathy the one to the other. Sympathetic colours are those which are allied in their tints, or apparently shades of the same original colour, such as brown and dark red, yellow and orange, &c. Such colours always produce harmony or union in painting, but destroy variety: on the contrary, antipathetic, or opposite colours, are those which are opposite in their tints, as red and blue, yellow and brown: such colours contribute to force or variety, but exclude union or harmony. Warm colours are those which bear a certain modified resemblance to the effects of sunshine or fire, which being of a bright yellow, or brownish red, all tints imitating them are considered to be warm: on the other hand, blue the colour of the sky, green the colour of the grassy field, lead colour the tint of water, these and others of the same character are called cold colours. These names are borrowed from the effect produced in the mind by the association of ideas; for yellow and red colours being observed as the usual attendants of the heat of the sun or a fire, we conceive them to be virtually united with the sensation of heat or warmth, and hence are led to imagine, that

that where such colours are exhibited, heat also should be found. On the other hand, the pure azure firmament, the verdant plain, the limpid stream or fountain, being communicated in our minds with the ideas of refreshing coolness, whenever we perceive the blue or green tints to predominate, the attendant notion of cold or coolness is sure to be excited.

To produce harmony of colouring, four different methods have been adopted: the first is that employed by the painters of the Roman school, in which the colours are laid on in a full and strong body, of which an admirable example may be seen in Raphael's master-piece, representing the *Transfiguration* of our Saviour on Mount Tabor. The second method is more peculiar to the school of Bologna, and is produced by what painters term the corruption of the colours, that is the mixing and breaking of them, until there is a general union in the whole piece, and nothing left in it that can give any idea of the colours originally employed to form the tints. These two manners of colouring are more particularly appropriated to the grand style of painting: the two following belong rather to the ornamental. The one is called the Venetian, being first practised by the painters of that school: but it was carried to greater perfection in the works of Rubens. In this mode the brightest colours that can be found are introduced, as also the extremes of warm and cold colours: these are reconciled by being dispersed over every part of the picture, until the whole appear at a distance, with regard to colour, as a bunch of flowers. The last manner is that adopted by Guido Reni, and followed with great success by many painters of the Dutch school; it is distinguished by a silvery gray or pearly tint predominating over the whole piece; and pictures of this sort are valued by critics, in proportion as they possess more or less of this silvery tint.

In the practice of every art, however, excellence is nearly allied to defect; the student therefore will do well to guard against the faults closely connected with the different beauties. Thus the first method here mentioned will, unless he be very careful indeed, lead him into a hard dry manner of colouring, of which he will find it difficult afterwards to divest himself. The Bolognian style from its great simplicity is apt to degenerate into insipidity. The golden manner of Titian, without the greatest nicety of hand to maintain it, will often become what painters call foxy: and the silvery tints of Guido, in unskilful hands, sink into a heavy leaden manner of colouring.

In general it may be observed in colouring, that the colour which forms the largest mass should be diffused over different parts of the picture: for a single mass of colour will have more of the appearance of an accidental blot than of a skilful imitation of nature. Thus in pieces containing a considerable portion of flesh colour, as when there are many faces, hands, &c. there should be a principal mass of the same colour. It is no less necessary for the sake of harmony that all the different colours, however they may be distinguished in their lights, should be nearly the same in their depths of shadow, possessing what the anticnt painters called an unity of shade. To produce force, solidity and strength, some part of the picture should be as light, and some parts as dark as possible: these two extremes are then to be harmonised and reconciled to each other, by a proper introduction of tints and demitints in gradation.

Though colouring considered, as it really is, as a mechanical part of his art, may not seem to deserve a large share of the painter's attention; yet when he reflects on the effects which colours are able to produce on the minds of both the uninformed observer and the critic, he will be convinced that the study of this part of painting is indispensable. He should in colouring avoid trifling or artful

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play of little lights, and the introduction of superfluous tints: a quietness and simplicity must reign over the whole work, which can only be effected by a breadth of simple uniform colour. Grandeur of effect it is true may be produced by two nearly opposite methods: the one is by reducing the colours to little more than *chiaro oscuro*, as was the practice of the school of Bologna; the other is by making the colours very distinct and forcible, like those of the schools of Rome and Florence; but still the presiding principle in both of these modes, and the cause of their success, is simplicity. Nothing is more simple than monotony; and the distinct blue, red and other colours of the draperies employed by the Roman and Florentine schools, though destitute of the harmony produced by a variety of broken and transparent colours, yet possess that grandeur of effect required, and strike the mind more forcibly than if they were softened into one another by a greater number of tints: thus martial music rouses the nobler passions, by the sudden and strongly marked transitions from one note to another, while the softer emotions are called forth by the melody and harmony of tones more united in their sound.

In colouring, the young artist may derive great advantage from the use of what is called the *camera obscura*, or dark chamber. Make a circular hole in the shutter of a window, from whence there is a prospect into the fields, or of any particular object at a convenient distance; and in this hole place a convex glass, whose focal distance is five or six feet: if the focal distance be less the figures will be too small, and if it be fifteen or twenty feet, they will be indistinct, and the colours faint. No light must be admitted into the room but through this hole and glass, at a distance from which equal to that of its focus, place a paste-board covered with paper of the brightest whiteness, enclosed by a black border to prevent any of the side rays from disturbing the picture. Let this paste-board be two feet

feet and a half in length, and eighteen or twenty inches in height: bend the length of it inwards in the arch of a circle whose radius is equal to the focal distance of the glass in the window; then fix it on a frame of the same figure placed on a moveable foot, that it may be easily fixed at the exact distance from the glsss where the objects are observed to paint themselves in the greatest perfection. When the paste-board is thus placed, all objects in front of the window will be represented on the paper, but in an inverted position, with the greatest truth, and in colours perfectly resembling nature.

Though this be undoubtedly the most accurate mode of constructing the camera obscura, yet it is often made of a portable size: a very useful one for artists may be constructed in a box having a glass or lens at one end fixed in a sliding tube; the images of objects are received on a plane mirror placed within the box and reclining backwards at an angle of 45 degrees, from which they are reflected upwards to the lid of the box, or to an oiled paper, or other transparent substance placed there for the purpose.

The camera obscura gives a faithful representation in every respect of the objects without: the image bears the same proportion to the object as their respective distances from the lens, that is, if the distance of the paper or skreen from the lens, be one tenth part of that of the external object from the lens, the image will appear in size one tenth of that of the object. The image is always inverted from the crossing of the rays of light at the lens, for the rays proceeding from the right side of an object must of course fall on the left side of the paper, and *vice versa*, while those proceeding from the top and bottom of the object must, for the same reason, fall respectively on the bottom and top of the paper. But what gives life and spirit to this sort of representation, and in which it excels all other imitations, is, that just display it presents of motion or rest in the

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several parts of the picture corresponding to what takes place in the original. The pictures in the camera obscura are not only just with regard to the colours, but in force and beauty they even exceed nature itself: every piece of imagery has not only its proper tints and gradation of colours, but it has them heightened and more intense than they are in the object; and hence is its great usefulness to the young painter: lights and shades are also represented in their various degrees, and in every possible variety.

When the painter has chosen his subject, his skill is discovered by the manner in which he narrates his story. The poet and the historian have a great advantage over the painter in this, that they can prepare the mind of their reader by a gradual display of events leading him to a full comprehension of the subject to be handled: the painter on the other hand is restricted to one particular action of his story, to absolute unity of time and place: it is therefore incumbent on him to fix on that particular point of his subject, which affords the most natural opportunity, not only of expressing his main scope itself, but of conveying to the spectator an idea of the circumstances preceding or following it. On this account invention is a most important point in the science of painting; and without excellence in invention no man can ever rise to the reputation of a great painter.

By invention it is not meant to express on canvas the discovery and representation of the truth of all circumstances as they actually took place in the scene presented to the eye, but only all such as may probably have taken place. By this probability may be introduced whatever is intimately connected with the subject, and likewise whatever by its sublimity or beauty may be most capable of exciting desired feelings in the mind of the spectator, and force him in some degree to forget that what he beholds is only a representation, and not the reality of the subject.

As in imitating nature we are by no means to take any individual object as it really exists in nature around us for a model, but to select from the whole species of objects all such particulars as possess the greatest excellence; so in the arrangement of a piece of painting we are to choose and draw together whatever circumstances or illusions may seem to have the most powerful tendency to convey to the observer those sensations and ideas which we propose to excite.

It is the business, nay it is the duty of the historian of nature and society to represent objects and facts correctly, and precisely as they exist or occur, with all their imperfections or blemishes: but the painter resembles the poet, whose business it is not to copy but to imitate the objects with which he is conversant: in other words, he is to work from his imagination, and represent objects and events with all the perfections and beauties of which his subject is susceptible. This proceeding is deeply rooted in human nature: by habit we come to associate certain ideas together not always connected with each other. The painter must therefore be most careful to present no object nor feature to the spectator, which by former associations may recal to his mind sensations either contrary or merely foreign to the great scope of his piece; at the same time that he introduces all such circumstances as are calculated to produce the effects he has in view. Here *la belle nature*, or nature methodised, embellished and perfected, must be the artist's guide: hence circumstances of the subject, exalted to the highest degree of sublimity and beauty of which they are susceptible, although they never really happened, are fully entitled to appear in the works of the painter of genius and taste. It is in this part of their several arts, that the painter and the poet (or the *maker*, as he was once very properly termed) resemble each other: and hence they are both enabled to throw into their productions more of

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the spirit of philosophic instruction and entertainment than the historian or the naturalist.

However ingeniously a piece may be imagined, that is with whatever skill the painter may have arranged in his imagination, the attitudes and countenances of the characters in his piece; still if these figures (or in landscape painting, if the various component parts) be not arranged and situated in the picture in such a manner as to contribute in the highest degree to the unfolding of his design, and to the production of delight in the spectator, he has done but half his duty. The artist must therefore endeavour, by the disposition of the several parts of his work, to express in the most obvious and lively way what his invention has provided.

The chief difficulty in disposition is to produce the most artful and ingenious arrangement, at the same time that this art, and this ingenuity, shall be utterly imperceptible, and that the whole shall seem to be merely the result of accident. For this purpose the artist must beware of imitating the dry formal manner practised by the earliest moderns on the revival of painting, for they generally arranged their figures like so many couples in a procession: neither must he follow the example of still more modern artists, particularly of the French school, who unable to express, in the genuine language of simple nature, the possessions and feelings of the characters they introduced, have represented them in a state of the utmost disorder and fluttering agitation, as if they were brought together for no other purpose but to quarrel and fight.

As in a dramatic or an epic poem, or in a romance, there must be some hero or heroine, who sustains the principal part in the conduct of the piece, and to whom all the other parts, however subordinate, bear a due relation; so in painting there must be one principal figure to arrest the eye and observation of the spectator, and to whom all

the other figures are to appear to be more or less subservient. This effect is produced in various ways, as by placing the figure in the front, or some other conspicuous part of the picture; by exhibiting it in a manner by itself; by making the chief body of light to fall upon it; by giving it the most splendid and brilliant drapery; or, indeed, by two or more or all of these methods together.

Painters, like dramatic writers, should compose their fable of the smallest possible number of persons: for nothing is so injurious to picturesque effect in painting, nor to dramatic consistency on the stage, as the presence of figures or persons, not necessarily connected with the matter represented, and whose appearance is not necessarily and obviously required. Some subjects, it is true from their nature, require a great number nay, even a multitude of characters; but still in these pieces the figures are to be assembled in companies, masses, or groups, in different gradations, all indicating their subordinate relation to one principal mass or group which ought, in the composition, to occupy a place corresponding to that of the principal figure or personage, in a piece where but few figures are introduced. The reason for thus breaking a composition into groups, is that the eye passing freely from one object to another, may the better comprehend the whole. The painter however is not to stop here, for these groups are still to be so skilfully put together as to form rich clusters, to give the whole composition an air of grandeur, and to afford the spectator an opportunity of discerning the piece at a distance, and taking in the whole, as it were, at a simple glance. These effects are greatly promoted by a due regard to the nature of colours, so as not to place together those which give pain by their opposition, or distract the attention by their variety. A proper use of the chiaro oscuro is likewise of great service on such occasions, for by introducing some strong falls of shade, and above all by one prin-

cipal beam of light, the groups are easily parted, and the whole picture acquires a very forcible expression.

Painters have agreed to express by the Italian term *costume*, all such circumstances in a picture as unite in representing the conformity of the resemblance to the original fact, as it has been handed down to us, or as on good reason and authority it may be supposed to have happened. This conformity is very extensive, including whatever relates to the manners of the times, the characters of the persons concerned, their dress and arms, the customs of the place, the buildings and style of architecture, the animals, trees, plants, the inhabitants, their occupations, amusements, &c.; in fine to whatever objects are peculiar to and characteristic of the fact to be represented. To attend to all these particulars is therefore no easy task; this attention is however indispensable to the truth of the representation; and the young artist will in vain hope to shelter his ignorance of them by pointing out the errors and defects in this important point, which are but too frequently seen in the productions of even the best masters of antient and modern times; these defects are passed over by the critic, only because they are lost in the brilliant beauties with which such productions in other respects abound. In the costume the Roman school was always extremely correct: on the other hand, the Venetian painters were in general, to the last degree, careless. The incomparable Titian himself made no scruple, in a picture representing the sufferings of our Saviour previous to his crucifixion, to introduce pages dressed in the Spanish garb of his days, and the Austrian eagle emblazoned on the shields of the Roman guards of Pilate. Tintoret, in a representation of the fall of manna in the wilderness, presents figures armed with muskets. Paul Veronese, in a Last Supper, introduces Swiss, Levantine, and other strange figures of his own times.

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The project attributed to a Dutch painter of representing, in the Sacrifice of Isaac, the patriarch Abraham preparing to dispatch his son by means of a pocket pistol, is scarcely a more outrageous offence against the laws of *costume* or *propriety*. In general the painter, in order to ensure success in his purpose, which is illusion or deception, ought carefully to avoid mixing the antique with the modern, the foreign with the domestic, things in short in their nature repugnant the one to the other, and therefore incapable of gaining credit with a spectator, who will never be able to consider himself as actually present at the scene presented to his view unless the circumstances entering into the piece perfectly agree among themselves, and the field of action be in no shape discordant with the action supposed to have happened on it.

It was observed by the late eminent artist Sir Joshua Reynolds, that the portrait painter who in his practice wishes to dignify this subject, as for example a lady, will not represent her in any modern dress, the familiarity of which is alone sufficient to destroy all dignity, He will take care that his work shall correspond to those ideas and that imagination which he knows must regulate the judgment of others, and therefore dresses his figure with something of the general air of the antique, for the sake of dignity, and with something of the modern, for the sake of likeness. By this conduct his work corresponds with those prejudices we have in favour of what we continually see; and the relish of the antique simplicity corresponds with what we may call the more learned and scientific prejudices of mankind. There was a statue of Voltaire made some time ago by a French Sculptor, who not having all that respect for the prejudices of mankind which he ought to have had, represented the original as meager and emaciated a figure as he really was: the consequence was what might have been expected, the friends of Voltaire were disappointed and offended, and the statue was never removed from the sculptor's shop.

MOSAIC

MOSAIC PAINTING.—This species of representation of objects is supposed to have had its name from its being chiefly employed by the antients in adorning a *museion* or *museum*, cabinet or study, dedicated to the *muses*: amongst the Romans it was called *opus musivum*. Mosaic or rather musaic painting, if we may so term it, is performed with small pieces of marble or other natural stone, cut into parallelopipeds like a die, but twice as long as they are broad or thick. These dies are of every variety of colour, and are fixed in due order in a cement applied to the floor or the wall of an apartment, a table, &c. The mosaic as practised by modern artists is however usually executed with small dies from one half to one quarter of an inch aside, but of greater length, composed of a semi-vitrified paste, tinged with every possible colour tint and shade.

The first step in executing mosaic is to have a correct drawing of the intended picture: a cement or plaster is composed of hard stone and brick, finely pounded and worked up with gum tragacanth and whites of eggs: this plaster is laid thick on the floor or wall to receive the painting, and only what is sufficient for the work of three or four days applied at one time, that the ground may not dry and harden too much for use. The drawing is then laid on the plaster, and the various outlines impressed on it by a sharp pointed tool, after which the dies, having been previously arranged in small cases, according to their gradations of colours, are lifted out and placed on the plaster in their proper situations, as their tints correspond with those in the original draught, the artist adhering scrupulously to the various lights, shadows, hues, and colours, of his model. The dies are pressed into the ground or cement by applying a rule over a number of them in different directions, to render the surface as regular and even as possible, by which the effect as a painting is much improved.

This operation it is evident must proceed very slowly: but

but when it is executed, the colours being incorporated in the substance of the die, reduced by fire nearly to the state of glass, are never affected by the air, moisture, or any external accident; and they possess a lustre not to be attained in any other mode of painting. In the capitol of Rome was some years ago preserved an admirable specimen of antient mosaic, representing three pigeons sporting on the margin of a vessel of water, of which Pliny has left us a discription: it was discovered in the ruins of Adrian's villa near Tivoli. The finest pieces of modern mosaic are also to be seen in Rome, particularly in St. Peter's church, where, as paintings from humidity or the smoke of tapers and lamps or other causes were liable to be damaged, copies in mosaic of many masterpieces of modern painting have been substituted, in which the design, the colouring, the delicate gradation of tints have been so closely and so skilfully imitated, that, at a proper distance, the eye cannot determine whether what it admires be a painted canvas or a piece of mosaic. Adjoining to the church was the place where the operation was carried on, and greatly encouraged by the late Pope Pius the Sixth. One of the niceties of the art is to compose the dies of such substances and in such proportions as shall, after exposure to a violent heat, produce precisely the tints required; an operation requiring great skill and attention in the persons employed to perform it. Various other modes of imitating natural objects have been practised; we are told that the antient inhabitants of Mexico had arrived at a wonderful dexterity in a sort of mosaic painting performed with the feathers of the great variety of birds with which that region abounds. Similar works have been done in different parts of Europe, and the art of painting, if we may so speak, with wool, silk, &c. of different hues, has of late years been brought to high perfection in this country.

PAINTING IN FRESCO.—This is considered to be the most

most antient, the most speedy, and the most durable branch of the art of painting, as well as the most suitable for ornamenting great edifices. From the fragments that have come down to our times, it appears that the Romans worked much in this way: and travellers tell us that in Egypt, colossal figures of vast dimensions are observed on the walls of palaces and temples, incorporated with the substance of the plaster.

In paintings in *fresco* (so called from the Italian word for *fresh*) it is first necessary to apply to the wall two or three layers of plaster composed of pounded brick, or of what is still better, river sand and lime. The first layer must be perfectly dry before the second, on which the painting is to be executed, be applied. The second consists of lime slaked in the open air, and left exposed for a year to the weather, mixed with river sand of a grain even and moderately fine. This is applied with a trowel on the first layer, whose surface has been previously wetted to make the two unite; and the application requires great skill and care in the artist, that the last surface may be perfectly regular, even and smooth. A fine polish is given to this second layer, by applying a sheet of paper to it, and again going over the surface with the trowel. The artist employed on this preparatory work should lay on only so much ground as the painter can execute in a day, as this kind of painting can only be performed when the ground is fresh laid on, moist and smooth. As the painter must work rapidly, and as there is no time to retouch any of the strokes, he has lying by him large cartoons, on which are correctly drawn, in their full size, the figures to be represented, that he may have nothing to do but to copy them on the wall. These cartoons consist of a number of large sheets of strong paper, either single or several sheets pasted together, which are applied to the surface of the plaster, and the various outlines, features, &c. are traced on it by going

over the cartoon with a small point, or by merely pricking small holes through the paper. When thus an accurate and speedy drawing is obtained, the colours are next applied: these are laid on while the plaster is moist, and ought never to be retouched when dry, for those then applied are sure to turn black.

Painting in Water Colours.—This style of painting can only be considered as coloured drawing, in which the white surface of the paper serves for the light. The middle tints are done with transparent colours, and are of course of no thickness of body on the paper. The shadows are first prepared with Indian ink, and afterwards glazed agreeably to the various tints and tones of the objects to be represented. The tints are composed in the same way with those in the style of painting which the French call *gouache*, and we *body colours*, with this difference, that white is never employed, and that the colours are laid on very thin.

The objects ought to be represented more brilliant than they are in fact, on account of the Indian ink used in the first wash or preparation, which always diminishes the strength of other colours applied over it. Prussian blue, having a tendency to turn dark or black, ought seldom to be used in this sort of painting.

The very expeditious manner by which the endless variety of natural objects around us can be thus represented, renders drawing or painting in water colours exceedingly valuable as well as agreeable; and it is from it that many artists have drawn their first knowledge of the effects of colouring.

In painting with *body colours*, or in *gouache*, the first thing to be done is to paste the paper on a board of mahogany or walnut-tree made perfectly smooth and even in all directions, pasting another similar sheet on the opposite side, that the board may be equally acted upon, and so kept from

from warping. When the paper is thus prepared, the outlines are drawn with a black lead pencil, taking care they be sufficiently strong to resist the application of the first colours. The sky of the landscape is then formed with a tint composed of white mixed with Prussian blue, and a very small quantity of red lake to give the air a little warmth. The mountains are done with a stronger tint, mixed with blue and red, to give them some relief from the sky. Trees, rocks, water, &c. are done with their most natural tints, according to their respective distances, and their position with regard to the lights. When this first course is executed, the leaves and other minute parts of the objects in the landscape are introduced; and when the work is done the whole is glazed over with some light transparent tint, to give the several colours their proper union and harmony.

MINIATURE PAINTING.—This beautiful branch of the painter's art consists of very small lines, or rather of points and dots done with very simple colours, mixed up with gum, upon paper, ivory, or vellum: ivory, when well prepared, is however by far preferable to paper or vellum. Paintings of this sort are distinguished by the smallness and delicacy of the figures, and the light transparency of the colouring.

In miniature, the first thing to be done is what is called the dead colouring, in which the lights are kept a little brighter, and the shades less dark than they are ultimately to be made; because in dotting on them afterwards the colour is always strengthened, and would thus become at last too forcible. The dotting is performed in different ways by different artists, some making the dots round, others oblong, others again hatch with little light strokes crossing each other in all directions, which method is the most expeditious, as well as the freest, and therefore deserves to be generally practised.

PAINTING IN PASTEL OR WITH CRAYONS.—By *crayons* in general, we understand all coloured stones, earths, or minerals, whether these substances be used in their original state, and only cut into long narrow slips, or pounded and brought to a paste with gum water, and then formed into pastels.

In painting with crayons, the student is to be provided with strong blue paper, the thicker the better, if the grain be not very knotty or rough: this paper is pasted down on a linen cloth previously strained on a wooden frame. When the paper has been dead-coloured, it is laid on its face on a smooth board or table, and the back brushed over with paste; the cloth on the frame is then applied to the pasted side which adheres to it, and being turned up, the paper is gently pressed down to make every part unite with the cloth; after the pasting the crayons will adhere better to the paper, and consequently give the picture a firmer and brighter body of colour.

In painting with crayons from the life, it is best to make a correct drawing of the outlines on a separate paper in the proper size of the intended picture, to be afterwards traced on the framed paper, because false strokes of the crayon, which without great expertness are unavoidable, will prevent after-strokes from readily remaining on the picture.

The success of this kind of painting depends greatly on the quality of the crayons, which ought to be of a brilliant tint. When the paper, cloth, or vellum, are sufficiently prepared, the artist begins the sketch with a dark crayon, correcting the outline with one of a reddish brown. When any part is to be effaced, the colour is rubbed off with a bit of linen, and then a little good pounce *(pumice)* firmly ground and sifted through a piece of silk, is rubbed on the erasure with the finger: the pounce is then blown away, and the crayons employed as on clean paper.

In painting with oil colours, the requisite tints are arranged on

on the palette before the artist begins to apply them to the canvas: but with crayons it often happens that several tints must be laid one upon another, to produce by the blending of their lines the colour and tints required.

The common fault of beginners is, that they use too little colour; it is true that in all objects great skill is necessary in selecting the proper tints; but when by their combination the student finds he can produce the desired colour or shade, the crayons should be applied with freedom and boldness, without sparing the pastels, for fear of laying on too much colour.

When the whole piece is sketched in so as to produce a proper effect at a distance, showing that the lights, shades, and reflections are duly arranged, the artist then examines whether a sufficient body of colours be laid on, to allow of their being blended and sweetened into one another with the finger. In blending the colours care is requisite for preserving the ease, freedom, and spirit of the first draught or outline, otherwise there is a risk of losing what most contributes to the resemblance of the original object.

When all is done, the colours must be fixed by the application of a gum, composed of isinglass, spirits of wine and water, gently sprinkled over the picture from the end of the hair of a brush: by this process the particles of the crayons will be connected to each other and to the paper, sufficiently to prevent their being rubbed off by any slight pressure or friction.

Painting in Enamel.—Enamelling is the art of applying colours on gold, silver, and other metals by means of fire or the lamp. The enamel is usually composed of vitrified substances, interspersed with others not vitrified, so that it possesses the properties of glass, only it is not transparent. The basis of enamel is a pure glass, ground up with a calx of lead or tin prepared for the purpose, and commonly with the addition of white salt of tartar: these ingredients

ingredients baked together, with powders of different colours, furnish enamels of all sorts.

Enamelling is not more solid and durable than difficult to execute. The painting is performed on metal plates, covered with a coat of white enamel: gold is often used for this purpose; but copper when well managed is almost as good. These plates are made concave on one side, and consequently convex on the other, and they are usually circular or oval: if they were flat there would be a risk that the enamel might fly off, in undergoing the action of the fire or lamp. The convexity of the plates, however, must not be considerable: for this would injure the effect of the painting, as the sight could not rest on the whole of the subject at once; the light necessarily falling on the prominent parts would give them a brilliancy injurious to the effect of the other parts on which it did not fall in the same manner.

The colours used in enamelling are all calxes of metals, mixed and melted with certain proportions of vitreous substances which, at the instant of their fusion, discover their several tints and fix them on the metallic plate. This melted glass or enamel produces the same effect that oils, gums, or glues produce in other processes of painting: it unites the different particles of the colouring materials, makes them adhere to the surface of the enamel, and incorporates them with itself: when properly managed it gives the colours a brilliancy and polish not to be obtained in any other way.

Without attempting to enter in this place into the manner of procuring the various colours used in enamelling, it will be sufficient just to mention, that from gold are formed the scarlets, purples, pinks, and violets; from silver and antimony the yellows; from copper the greens; from cobalt the blues; from iron the deep reds, browns and blacks; from tin the whites.

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In working, the outline is faintly drawn on the ground with a blacklead pencil, and the colours are applied in the same way as those in miniatures on ivory; observing that on the application of each coat the plate must be exposed to the furnace or lamp. The artist must endeavour to unite and harmonize all the touches of his pencil, which will be very difficult, not to say impossible, if after beginning the work he should lay it aside for any considerable time; as he would no longer remember the way in which he had formed his tints, and would be liable to place upon or near to each other, such colours as have no proper relation. Hence may be conceived the difficulty of properly uniting all the parts of a large enamel painting. The merit of the picture may be acknowledged by the generality of spectators: but the real merit of the artist can be appreciated by those alone who, acquainted with the art itself, can understand what difficulties he must have overcome to bring his work to such a state.

Other modes of painting have been practised, such as that to which the term *encaustic* has been improperly confined, for all enamelling, or other methods in which the action of heat or fire is employed, is in fact encaustic; but what is commonly so named, is a way of employing wax and certain gums to give a gloss to the colours.

Elydoric painting is a method of executing miniatures in oil colours, while the picture and the masses of colours are both constantly covered with water, from which circumstances this method has its name, *hydor* being the Greek term for water, as the former word encaustic is derived from the greek *kaustos*, what has undergone the action of fire.

Painting on Glass.—Under this title various modes of operation are comprehended. The most antient was very simple, being in fact only a sort of inlaid work or mosaic, executed with pieces of glass stained with various colours: then larger pieces of stained glass were used, and

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the features and shades applied to them by means of other coloured substances: lastly, the colours were incorporated in the materials of the glass itself, by the operation of fire. This idea is said to have been first suggested by a French artist at Rome, but Albert Durer, and Lucas of Leyden, produced the earliest specimens of the art approaching to perfection.

The colours used in staining or painting glass, are very different from those employed in working with oil or water colours. Of the former the following are examples; blacks are obtained from scales of iron, scales of copper and jet, all in equal quantities. For blues, take of powdered blue one pound, and salt of nitre half a pound, well mixed. For carnation colour, red chalk eight ounces, iron scales and litharge of silver, each two ounces, gum arabic half an ounce, mingle these ingredients in water and grind them together, leaving them to settle for a fortnight in the vessel. For green, take red lead one pound, copper scales one pound, flint five pounds, put them with some nitre in a crucible, in a very strong fire, and after they are melted and cold, grind the mass to a fine powder. For gold colours, take silver one ounce, antimony half an ounce, melt them down, and grind the mass, adding to the powder fifteen ounces of yellow ochre, and then reducing the whole to a fine powder by grinding them in water. For purple, take red lead one pound, white lead one pound, white flint five pounds, brown ochre one pound and one third of a pound of nitre, calcine and melt them down together and reduce them to powder. For red, take of jet four ounces, litharge of silver two ounces, red chalk one ounce, powder and mix them. For white, take jet two parts, and white flint ground fine one part, and mix them together. For yellow, Spanish brown ten parts, silver leaf one part, antimony half a part, and calcine them together in a crucible.

In the windows of antient churches, are frequently seen the

the most beautiful and lively colours, far exceeding those usually employed by modern painters on glass. This difference is occasioned not so much by ignorance of the methods pursued in those times, as by the high price of the requisite materials, which would not be defrayed by the little demand there is in the public for works of this nature. Formerly the colour was infused into the substance of the glass itself, or it was only applied on one side, penetrating but a short way into the glass; this last could be done only with certain colours, because others, as yellow for instance, was always found to pervade the whole substance, or at least to go very deep.

In the art of painting on glass, as it is practised in modern times, the first thing to be done is to draw and colour the design on paper: then the artist chooses such pieces of glass as are clear and smooth to receive the several parts of the drawing, distributing them so as to suit the pieces of glass, making the outlines or contours of the figures to fall in the joinings of the several pieces, that the carnations and other bright and transparent parts of the work may not be covered by the leaden joinings of the glasses. When this distribution is made, each piece of the glass is marked, corresponding to that part of the sketch to which it belongs: thus the design is transferred from the paper to the glass, by means of a black colour, formed as was before described, diluted with gum water, following all the lines and strokes as they appear through the glass, with the point of a pencil. The other colours are applied with gum arabic, much in the same way as in miniature painting.

When the painting is completed, the pieces of glass are carried to the oven or furnace, where by the intense heat the colours are incorporated with the substance of the glass. In the furnace the glasses are placed in an earthen pan, separated by layers of pulverised quick lime: the whole furnace is then covered with a broad flat tile, and closely stopped

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all around. When this baking or annealing is finished, the fire is extinguished as quickly as possible, to prevent the glasses from being broken, and the colours from being burnt dissipated or changed.

Engraving.—Engraving is executed on various substances, metals, stone, wood, glass: that on plates of copper is generally understood when engraving is mentioned. This consists in forming concave lines, on a smooth surface of copper, conformably to some delineated figure or design, by means of either a sharp cutting tool, or of some corroding solvent liquid, so as to render the plate capable, when charged with any coloured fluid, of imparting by pressure an exact representation of the figure or design to paper or other proper substance.

Of engraving there are many varieties, such as the following, viz.

1. Engraving in strokes with a sharp pointed tool; the copper-plate being first covered with a composition or ground, and the strokes afterwards corroded with aquafortis; this is termed *etching*. The ground is composed in different ways, but commonly of pure wax, mastic, bitumen and amber; these substances are reduced to powder and melted over a slow fire, they are then poured into water to consolidate, and made into balls for use. When the ground is to be applied the copper-plate is heated, but so as not to be smoked; a ball of the composition tied up in a piece of thin silk is then rubbed over it, observing that the composition be as equally thick as possible in every part of the plate. The ground is next smoked by holding it over a lamp; and when the plate is cold, the outlines of the print or drawing may be traced on the ground. These outlines are obtained by applying on the ground the back of the print, &c., previously rubbed over with red chalk, flake white, or black lead in powder, or any other substance that will readily yield a legible mark; then with a blunt needle trace,

trace lightly all the out-lines, the shadows, &c. &c. of the drawing. When this operation is finished the drawing is removed, and the plate is ready for etching, which is performed by tools nearly resembling sewing needles, but stronger, and inserted into handles, the points being of various sorts for the different parts of the work. With these tools the etcher, following the outlines he has traced, penetrates through the ground to the copper, making the strokes stronger or fainter conformably to the lines in the original drawing or print. When the etching is finished a border of soft wax is raised all round the work on the plate about an inch in height, and some aquafortis mixed with water is gently poured on the plate, when it will soon begin to corrode the copper in the strokes made through the ground. When the corrosion or *biting*, as it is termed, is supposed to be sufficient on the fainter parts, the aquafortis is poured off and the plate washed with water and dried; that part of the ground being scraped away the copper may be examined. When the fainter parts of the work are sufficiently bitten, they are stopped up with a proper varnish, and the aquafortis is again applied to excavate the remaining stronger parts of the etching. By heating the plate the border and ground are easily removed, the plate cleaned, and any defects supplied by means of a graving tool.

2. Engraving in strokes with the graver alone, unassisted by aquafortis.—In this species of engraving the design is traced with the dry point, (which is a sharp tool,) upon the plate, and the strokes are cut in the copper by the graver: this is generally called engraving with the tool and dry point only.

3. In strokes, but which are first etched with aquafortis, and then finished with the graver, by which the two former methods are united. This mode is the most commonly practised, and has also the best effect.

4. In dots without strokes, which are performed with the

point upon the wax or ground, and then bitten in with aquafortis as in etching; but these dots are afterwards softened and harmonised by means of the graver making small additional dots between them. This mode is sometimes executed with the graver alone, in the carnations and other finer parts of portraits.

5. In dots which, like the foregoing, are first etched, and afterwards harmonized with the dry point assisted by a little hammer, instead of the graver, for which reason it is termed *opus mallei*, hammer-work; but this method is now nearly exploded.

6. In *mezzotinto*, which is performed by covering the plate with a strong dark ground or deep shade, by means of a toothed tool, and corroding the dots with aquafortis. The parts which are to be light are then rendered more or less smooth by the scraper, according to the degrees of illumination they are to represent.

7. In *aquatinta*, a mode of engraving lately invented, but now brought to great perfection in this country: in this the outline is first etched, and afterwards the copper is corroded in such a manner, that an impression from it exhibits the appearance of a colour or tint laid on the paper itself, or of a drawing in Indian ink. This is accomplished in various ways, by covering the copper with some substance which assumes a granulated form, thus preventing the acid from acting on the copper in the places where its grains adhere to the plate; and consequently the copper is but partially corroded. The more minute are the particles of the grain, the more nearly will the impression resemble a drawing of Indian ink; but the larger the particles are, the more distinct will be the granulation.

8. Engraving on wood is performed with one block, or with several. When one block of wood is used, the design is traced on it with a pen, and those parts corresponding to the lights or whites of the design are carefully hollowed out;

out; the letter-press printers afterwards employ this block in the same way as they do the types in printing a book. When two, three, or more blocks of wood are employed, the first has the outline cut upon it, the second contains the darker shadows, the third the shadows terminating on the lights; these are all used in succession, each print receiving an impression from every block. This mode of engraving was designed to represent the drawings of the old masters of painting.

Of all the foregoing modes of engraving, the most antient is that on wood, or rather the earliest impressions on paper were taken from carved wooden blocks. For this invention the world is probably indebted to the makers of playing-cards, who practised the art in Germany, about the beginning of the 15th century; the earliest date of any wooden cut is 1423. Germany also had the merit of producing the first prints from engraved copper about the year 1450; the earliest date however is only in 1461.

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MODERN PRECEPTOR.

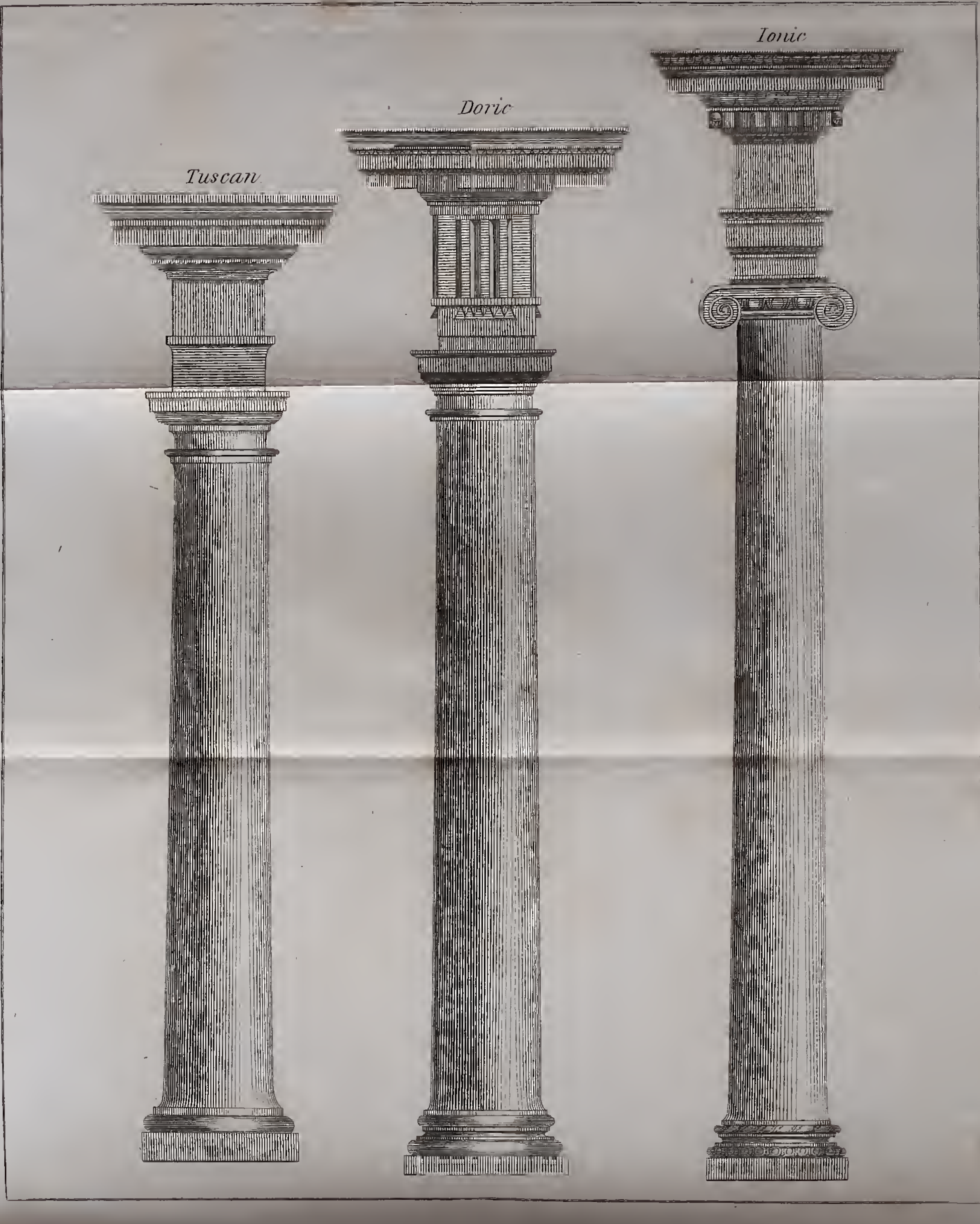
CHAPTER XI.

OF ARCHITECTURE.

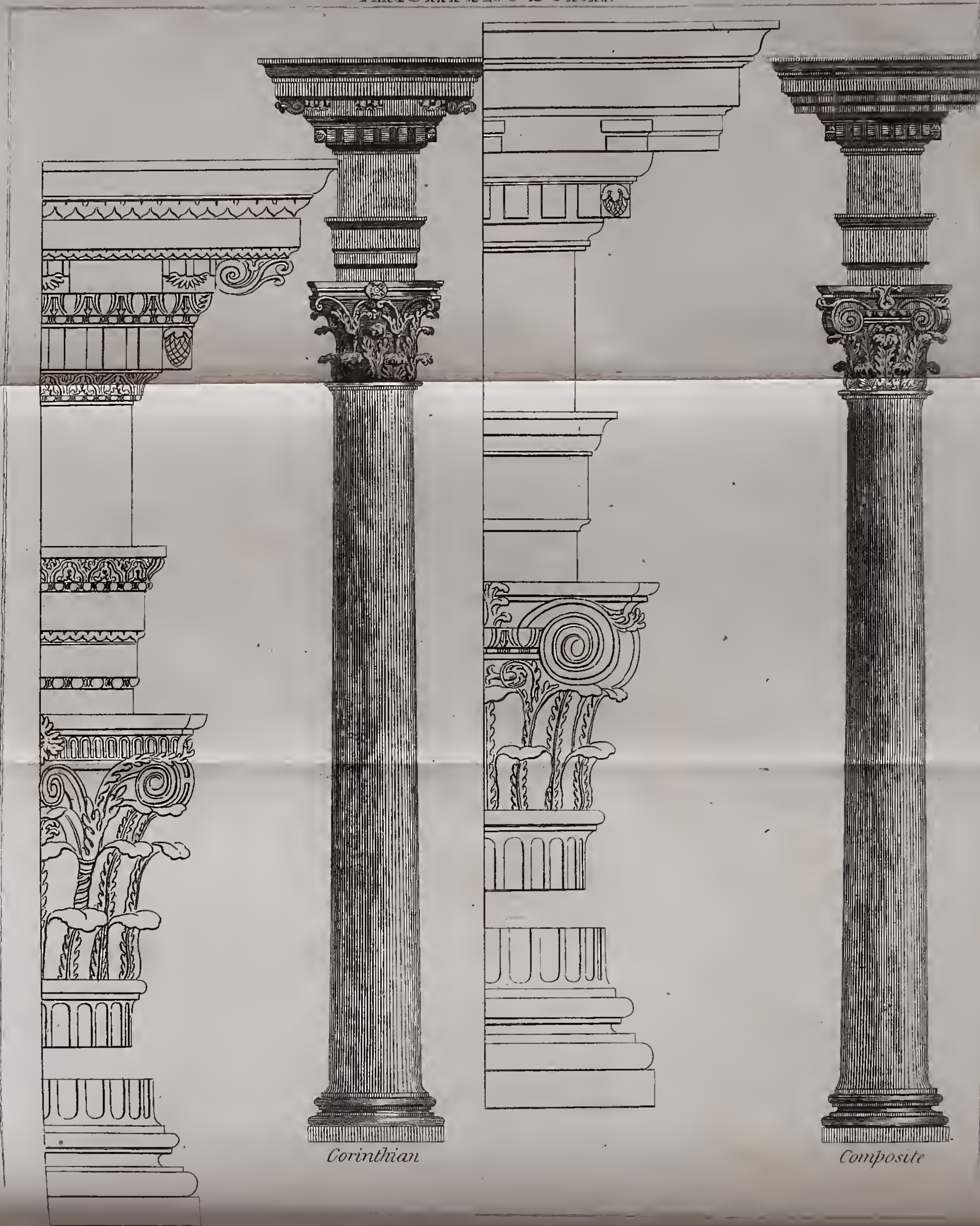
THE term *Architecture* is formed from the Greek language, signifying originally the chief trade or handicraft: but it has long been confined to the art of constructing edifices of every kind, for the use and comfort of man. Shelter from the inclemencies of the weather, even in the genial climates where the human race were first planted, and protection from the wild beasts of the field, must have been amongst the first wants of men; architecture, however rude and simple, must therefore have been one of the earliest arts to which necessity gave birth.

Vitruvius, whose celebrated treatise on Architecture was composed in the reign of Augustus, has left us the following fanciful conjectures on the origin and progress of the art of building. "Antiently," says he, "men lived in woods and inhabited caves, but at last, taking the hint perhaps from the birds of the air, which build their nests with equal ingenuity and industry, they formed for themselves huts. These were probably at first of a conical figure,

because


Tuscan
Doric
Ionic

ARCHITECTURE.



because this figure is of very simple construction, consisting of branches of trees spreading wide at the bottom, and united in a point at the top, covering the whole with reeds, leaves and clay, to defend them from the tempest. Finding however in the course of time this conical figure inconvenient, on account of the slope of its sides, they changed the form of their huts, giving them that of a cube or of a parallelopiped. Having marked out the space to be occupied, they fixed in the ground several upright trunks of trees to form "the sides, filling their intervals with branches closely interwoven and covered with clay. The sides being thus completed, four long beams were placed on the upright trunks which, being well joined at the angles, kept the sides firm, and likewise served to support the covering or roof of the building, composed of many joists on which were laid beds of reeds, leaves and clay.

" When the art of rearing their habitations was thus far advanced, men began to contrive methods of rendering them durable and elegant as well as commodious. They took off the bark and other unevennesses of the trunks forming the sides, raised them above the humidity of the ground by placing them on stones, and covered each upright post or trunk with a flat stone to defend it from the rain. The spaces between the ends of the joists were closed with clay or some similar substance, and the ends of the joists themselves were covered with thin boards cut in the form of the ornamental parts now called triglyphs. The position of the roofs was likewise altered: for being, on account of its flatness, unfit for throwing off the rains, the roof was raised in the middle into the form of a triangle or gable, by placing rafters on the joists to support the branches, turf, and other materials composing the covering.

" From these simple elements architecture took its beginning; for when buildings of wood were laid aside, and men set themselves to construct more solid and stately

edifices

edifices of stone or clay dried in the sun, they still imitated those parts which necessity had originally introduced into their dwellings; insomuch that the upright trunks, with the stones at their upper and lower ends, presented the original model of columns, capitals and bases; and the beams, joists, rafters, layers of materials, that formed the covering, produced the several parts of improved architecture called architraves, friezes, triglyphs, cornices, with all their attending ornaments.

"The first buildings were, it may be imagined, rough and uncouth; but when from experience and observation rules had been formed, proper tools invented, and facility in executing designs had been acquired, men made rapid advances towards perfection, and at length discovered certain modes of building which succeeding ages have regarded with the highest veneration."

Architecture is divided into various modes, deriving their names from a principal member of the edifice, viz. the column. These modes, or *orders* as they are usually termed, are five, the *Doric*, the *Ionic*, and the *Corinthian*, invented as is generally supposed amongst the several Grecian nations whose names they bear; the other two orders, the *Tuscan* and the *Composite*, are the production of Italy, in its different stages of rudeness and refinement.

An order in architecture consists of two principal parts, the column and the entablature, of which each is composed of three inferior parts: those of the column are the base or foundation on which it rests, the shaft or tall tapering part, and the capital or ornamental portion at the summit: those of the entablature are, in their order rising upwards, the architrave, the freeze, and the cornice. These parts are again subdivided into many smaller members, by whose number, form and dimensions, each order is characterised.

The *Tuscan* is the most simple and solid of the five orders: it consists of few parts, is devoid of ornament, but so

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massy as to be capable of supporting the greatest weight. The height of the Tuscan column is always seven times the diameter of its lower end, and the diameter of the top of the shaft is commonly made five-sixth parts of that at the bottom.

The *Doric* Order is next in strength to the *Tuscan*. It is considered to be the most antient of all the orders, and in its form and ornaments retains considerable resemblance to the structure of the original hut already described from Vitruvius, the triglyphs on its frieze representing the ends of the joists, and the mutules of the cornice imitating the rafters. The height of the Doric column, including its base and capital, is eight diamaters, or sixteen semidiameters, also called modules, of its lower end. In many of the most antient Greak buildings now remaining, the Doric column appears to spring immediately out of the ground, without any base; and in this manner it is given by Vitruvius, who says that the base was first introduced in the Ionic order.

The *Ionic* Order is more tall and slender than the preceding, its appearance is simple yet graceful and majestic; its ornaments are few, so that it has been compared toa venerable matron, in delicate and becoming rather than magnificent attire; the base which is said to have been first employed in this order has been supposed to imitate her sandals. Among the antients the proportions of the Ionic order seem to have been more accurately determined than those of any other; for very little variation is discovered in its measures on such antique monuments as have subsisted to our times. The height of the Ionic column is nine diameters, or eighteen modules of its lower end: the shaft of the column may be either plain or chanelled into flutings extending in some cases the whole height, in others only one-third of the height from the base.

One ornament peculiar to the Ionic column is the scrol

or volute which adorns the capital, supposed to be borrowed from the curling locks of a female figure, or more probably from the turning down of the bark on the primitive column made of the rude trunk of a tree.

The proportions of the *Corinthian* order are very delicate: it is divided into a great variety of parts, and enriched with a profusion of ornaments. The Corinthian column should be in height ten diameters, or twenty modules of its lower end: when the entablature is enriched, the shaft should be chanelled or fluted.

The beautiful capital of the Corinthian order is said to have owed its origin to the following circumstance:—A young Corinthian maid dying, her nurse brought her play-things in a basket, and placed it on the ground beside the tomb; the basket, covered with a flat tile, by accident rested on a plant of *Acanthus*: the leaves springing up round the basket, and meeting with the projecting edge of the tile, were turned downwards at the extremities. A sculptor, *Callimachus*, passing by the tomb, observed the graceful appearance of this group, and soon after introduced it as an ornament of the capital of a Corinthian column.

The *Composite* Order is, as its name imports, not so properly a separate order as one composed of members and ornaments borrowed from the others: in general appearance it seems to be only a variety of the Corinthian, being like it tall and slender; but the capital, in addition to the basket and leaves, admits the scroll or volute of the Ionic order.

In general, in all the five orders, the whole height of the entablature is allowed to be one fourth part of that of the whole column.

Besides columns properly so called, *Pilasters* form a very essential part of architecture. The chief use of pilasters is to support great weights, in particular arches: for though columns are in some cases introduced with arches thrown from the one capital to the other, yet as columns gradually taper

taper and diminish in diameter, and consequently in strength, as they rise from the base to the capital, they have an appearance of delicacy, and even of weakness, and therefore ought never to be employed to bear an arch. On the other hand, pilasters being square, and not round like columns, and usually made of the same diameter at top and bottom, they have in reality as well as in appearance, a considerable superiority in point of strength over the column.

Pilasters are applicable to the inside, as well as to the outside of buildings, for as they are generally made to project only about one-fourth part of their diameter from the walls to which they are applied, they occupy but little room: in other respects pilasters are commonly made in profile and ornaments to resemble the columns of the same order.

Both columns and pilasters are often raised upon pedestals, a construction not without its propriety in some particular cases, as in certain protestant churches, where the galleries are supported by pilasters, the front of the gallery corresponds to the pedestal, and the column supporting the roof springs from the front desk.

Pedestals, although by no means essential to columns or pilasters ought, when employed to receive such ornaments on their cornice and other parts, as are peculiar to the order of columns they are to support.

Although a column be, from its tapering form, an object of beauty in itself, yet as no true beauty can be found where utility is not apparent, a single column can seldom be introduced with a good effect: but rows of columns in succession are highly ornamental.

The antients placed their columns at different distances asunder, according to the order to which they belonged. Those intervals, or *intercolumniations*, varied in the Doric Ionic and Corinthian orders, from one diameter and a half

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of the columns at its base to four diameters: In the Tuscan order the intercolumniations were often very wide, the architraves being of wood, and therefore requiring less frequent supports than those of stone. The intercolumniation called the *Eustyle,* containing two diameters and a quarter, has been in general preferred to any other, by antients as well as moderns, as being both solid and sufficiently open and spacious.

Arches may perhaps be considered as less magnificent than ranges of columns: but they are more solid and very picturesque. Arches are with great propriety employed for a triumphal entrance, the gate of a city, the approach to a noble mansion, and in general in all situations where a wide open admittance is required.

The proportions of an arch vary according to circumstances: but the height of the aperture should never much exceed nor fall short of double the breadth; the breadth of the pier should not exceed two thirds nor be less than one third of the breadth of the arch: the thickness ought not to be more than one third nor less than one fourth of that breadth.

It is not unusual to place one order of columns above another; in this case care must be taken to place the strongest in the lower range, thus making the Tuscan support the Doric, the Doric support the Ionic, the Ionic the Corinthian or Composite, and the Corinthian the Composite. In such ranges, of columns it is usual to make the greater diameter of the upper columns equal to the less diameter of the lower columns, by which arrangement the succession of columns has the air of being one tall tapering tree cut into separate portions.

The principal objection to the architectural distribution of St. Paul's of London is, that the exterior both of the portico and the body of the edifice is divided into two ranges of columns and pilasters: an arrangement more suitable for

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a dwelling-house in which each range of columns may be supposed to support the several floors into which the house is distributed. This however is to be attributed to the difficulty of procuring blocks of stone of sufficient bulk to allow of columns of greater diameter being cut from them, and not to the want of taste and skill in the architect. The columns and pilasters of the portico and body of St. Peter's of Rome extend at once from the ground to the attic: but then as the intervals between the columns of the portico have been built up and divided into two stories of arcades and windows, the grand effect of such a portico is destroyed, and instead of a magnificent and lofty open range of columns, the spectator is mortified in observing them sunk as it were in a wall, which seems rather to have been built at a later period to give strength and support to the frontispiece;—a blemish from which St. Paul's is entirely free.

Columns grouped or clustered, that is placed in pairs, the one by the side of the other, are also improper; for they suggest to the spectator the idea that one range of columns having been originally erected, they were found to be insufficient to support the superincumbent weight, and a second range were introduced to assist in bearing the burthen. Columns in clusters are the productions of modern architecture, and have been but too commonly introduced in this as well as other countries.

Instead of employing different ranges of columns, it is usual to throw the ground floor of an edifice into the form of a *basement* on which stands the order that is to ornament the front. This basement ought never to be in height more than the whole, nor less than the half of the columns or pilasters it is to support. Basements are generally *rusticated*: that is, the stones are cut and placed so as to resemble the rude blocks as they may be supposed to rise from the quarry: But in this the judgment and taste of the architect are to be displayed: the huge

rusticated

rusticated masses composing the exterior of a Newgate prison, admirably indicate and characterise the nature of the edifice; the less rude it is true, but still rusticated walls of a Carleton-house, are equally incongruous with a delicate and highly ornamented portico, and with the purposes for which that building is set apart.

Pediments were originally used to cover only sacred edifices; but in the end of the Roman republic, when magnificence and luxury had made great progress, they were also applied to private buildings. Pediments are made both triangular and as segments of a circle: the first sort however are not only more natural, as imitating the end of a raised roof, but lighter, of easier construction, and far more picturesque than the second sort. The circular pediment is now seldom seen, excepting over a succession of doors or windows, where it appears alternately with the triangular pediment. In triangular pediments it is customary to make the perpendicular height from one-fourth to one-fifth part of the length of the base. The *tympanum*, or void space contained within the pediment, is generally appropriated to receive historical or emblematical ornaments in relief.

The observations hitherto made apply only to the Greek and Roman modes of architecture: but there is an other species founded and proceeding on very different principles: this is the *Gothic*. This term has often been employed to designate all buildings not reducible to any of the five preceding orders: but they are now properly distinguished in this country, according to the supposed periods of their erection, into *Saxon*, *Norman*, and *Saracenic* or modern *Gothic*. The true Gothic is reckoned to have made its first appearance here in the reign of Henry II. Respecting its origin various opinions have been maintained; some imagining it took its rise from the intersections of the wide semicircular arches observed on the walls of Norman and Saxon buildings, which form an arch of 60 degrees, composed

posed of segments or quadrants of circles. Others have believed it was brought to the western parts of Europe from the Holy Land, by persons returning from the crusades. A different origin of Gothic architecture has been entertained by many competent judges, who say that when the Goths became masters of the Spanish peninsula, and gradually adopted the Christian religion already established in the country, having formerly been, like many other unenlightened nations, accustomed to worship the Deity in woods and groves, they endeavoured to imitate those places of worship in the edifices now erected of stone. With what success these northern conquerors executed their project, by the assistance of Saracen architects, whose exotic style of building very luckily suited their purpose, appears from this circumstance that no attentive observer ever viewed a regular avenue of well-grown trees intermixing their branches over his head, but it presently put him in mind of the long vista of a Gothic cathedral; nor ever entered one of the larger and more elegant edifices of that sort, but it presented to his imagination an avenue of trees.

Under this impression of the origin of the Gothic architecture, all the irregular transgressions of art and seeming offences against nature disappear: every thing has its reason and order, and a harmony arises from the application of means adapted to the end. For how could the arches be otherwise than sharp-pointed, when the workmen were to imitate the curve formed by the intersection of the branches of two opposite rows of trees? or how could the columns be otherwise then split into distinct shafts, when they were to represent the stems of a clump of trees growing close together? On the same principles they formed the spreading ramifications of the stone work in the windows, and the stained glass in the interstices; the one to represent the branches, the other the leaves of an opening grove; and both

both concurred to preserve that gloomy light which, to their untutored minds, inspired religious veneration and dread.

In even the most admired Gothic edifices, no regard seems to have been paid to the proportion between the length of the shaft of a column and its diameter: no rules can be deduced from the Gothic practice, as from that of the Greeks and Romans, to fix the proportions of the columns and its parts; neither are the intercolumniations determined. Examples of the widest difference in this respect are common, for instance in the nave of York cathedral and in the aisles of the conventual church of Newark-upon-Trent, both Gothic buildings deservedly admired but widely differing the one from the other, both in the proportion of the columns and in the intervals between.

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MODERN PRECEPTOR.

CHAPTER XII.

OF GEOLOGY.

GEOLOGY is a term formed from two Greek words, signifying a discourse concerning the earth: it comprehends that part of the history of nature which treats of the structure of the earth, of the arrangement of its component materials, and of the changes which these materials have undergone. By some modern naturlists the term *geognosy* has been substituted for *geology:* but the latter seems to merit the preference. Geology may be divided into two branches, the descriptive, containing a general account of the materials of the globe of the earth, and the speculative, which is confined to the theories by which attempts have been made to explain the manner in which the present appearances of the earth have been produced.

The study of geology is of the highest importance in many respects. By it the naturalist is made acquainted with a very extensive department of natural productions; to him the minerals composing the internal strata of the globe and the mountains which soar above its surface are

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objects peculiarly interesting. To the miner this study is of the greatest use, as it instructs him in the nature and arrangements of the various substances in the bowels of the earth, by which he is led from the discovery of one substance to direct his operations for the discovery of some other, the object of his research. By an acquaintance with geology the landed proprietor may be guarded against the artifices or the ignorance of a projector, and thus prevented from embarking in expensive and precarious enterprises, which have but too frequently ended in disappointment and ruin. But the study of geology possesses still a higher advantage: nothing has more contributed to demonstrate the truth of *the sacred writings*, and to clear up many difficult passages in them, than the discoveries lately made in the structure and arrangement of the earth. The original state of the globe is so intimately connected with that which it at present exhibits, that we cannot properly understand the latter without a reference to the former: and recent experience has shown that the obscurity in which the philosophical knowledge of this subject was involved, has been highly favourable to those systems of infidelity and atheism which in the last age were but too prevalent. Of this obscurity much has been removed; and the investigations of Whitehurst, Werner, Kirwan, Howard, and some other geologists, by proving that the supposition of a deluge is the only hypothesis on which we can account for the present state and appearances of our globe, have contributed as much to the advancement of rational religion as of philosophical knowledge.

The study of geology, like other parts of natural history, can be pursued with but little advantage in the closet: the student must examine the sloping sides of hills, the beds of rivers, the interior of caverns and mines, the recesses of ravines, and the utmost summits of mountains, before he can obtain the knowledge requisite to form a skilful and philosophical geologist.

geologist. While employed in these personal observations, however, he ought carefully to study the works of the best writers on the subject, comparing the facts stated by them with those he has himself observed. The writings on geology may be separated into two sorts, the first containing those which give a systematic account of the whole or of some portion of the whole science, such as Bergmen's Physical Geography, Kirwan's Geological Essays, Delametherie's *Theorie de la Terre*, Werner's works, &c. &c.; the second sort comprehending geological descriptions of particular countries, such as Born's Travels in Hungary, Ferber's Travels in Italy, Saussure's Travels in the Alps, Pallas's Travels in the Russian Empire, Tar's *Voyages Metallurgiques*, Travels in England and Scotland by Faujas de St. Fond, &c. &c.

The materials of which the general body of our globe is composed are variously distributed in various parts: in some places they form irregular blocks or masses, buried below the surface, or elevated to different heights above it. In most places, however, these materials are arranged in a more regular way, those of the same kind being collected into extensive masses lying in *strata* or layers, above or below a similar mass of another sort; or these alternate with each other to a considerable depth. At one time these layers or *strata* are found arranged in a direction parallel to the horizon, at other times they are placed vertically or perpendicular to the horizon, as if what had originally been laid horizontally had been lifted up and set on its edge. But it is more common to find the strata arranged in a direction between the horizontal and the perpendicular, or inclined at different angles to the horizon, in which case they are said to *dip*.

The uppermost layer or *stratum* is in most places covered with mold, evidently formed from the decomposition of substances once endowed with organic or animal and

 vegetable

vegetable life. In many parts this mold extends to a very considerable depth, constituting what is called the soil: in other places the mold is barely sufficient to form a coating for the inferior strata; and in some places it is entirely wanting.

Sometimes the strata are continued in a regular arrangement, preserving the same degree of inclination to a considerable extent; but more commonly they appear separated into parts, as if they had been broken asunder, and the several parts are often raised above or sunk below the corresponding portions to which they were originally united. The separations, which are usually in a perpendicular direction, are sometimes filled with fragments of the adjacent broken strata, but for the most part they contain mineral or metallic substances of a very different nature.

When these separations, cracks, or fissures are filled up with broken fragments of the adjacent strata, they frequently become the beds of rivers; when filled with a solid strong substance they form what the miners call a *dyke*; if a mass of mineral or metallic substance fill the fissure, or be insinuated between the strata, it forms what is called a *vein*; and these veins frequently spread in branches between the strata in various directions.

If the country in which the strata lie run in a waving direction of gentle hill and dale, the different substances usually preserve the same waving direction, keeping nearly parallel the one with the other. In those places where no remarkable dislocation of the strata has taken place, their distribution is in general regular, certain materials lying above or below certain others in an uniform manner.

From the accumulated observations of geologists all these materials may be arranged under two heads: the first class contains all those substances which are found more or less connected with the remains of *organized* bodies, (animals and vegetables), such as the bones, teeth, shells of

of animals, and the trunks, seeds, or other parts of vegetables: the second class comprehends those substances in which such remains of organized bodies are never found. Substances of this latter class being now generally considered as having been formed prior to those of the former class, they are termed primary, and the others secondary substances.

First. The primitive substances are usually reckoned to be granite, gneiss, micaceous schistus, quartz, argillaceous schistus, jasper, hornstone, pitchstone, hornblende, serpentine, porphyry, puddingstone and breccia, syenite, primitive trap, topaz rock, siliceous schistus.

1. *Granite* is a name applied to all stones composed of quartz, feldspar, and mica, distributed in such a way that each substance appears in a separate state; but as this definition is too vague and comprehends many varieties, by granite is now understood that stone in which the three component substances appear in the form of grains or crystals. Of these substances the feldspar is generally in the greatest proportion, and the mica in the least.

Granite is found in the lowest and the highest situations of the earth that have hitherto been examined: it forms the basis of all the other strata; and although these are sometimes found below the granite, such a position seems to be the consequence of some accident or convulsion of nature.

Many mountains appear to be wholly composed of granite; sometimes immense masses of it are found detached in situations at a distance from the mountains to which they probably once belonged.

Granite is commonly found in vast blocks, separated the one from the other by rents or chasms irregularly disposed; this is the case in most mountains, especially in those terminating in high pointed spires.

Naturalists have doubted whether granite is ever found in

in layers or stratified; but late discoveries leave no room to deny that such is at times the case.

Granite constitutes the base of most of the British mountains; but it is most common in the western and northern parts of the island. A mass of granite runs through the length of Cornwall from Dartmoor to the Land's End, and the highland mountains of Scotland abound with it.

Granite seldom affords mineral substances; iron ore is, however, not uncommon in it, giving it a reddish tinge, but the metal most frequently found in granite is tin, as in the great mining tract of Cornwall.

2. *Gneiss*, or *kneiss*, differs from granite rather in the arrangement than in the nature of its component parts, which are found in the form of layers or like slate. It is sometimes incorporated with masses of granite, but in general it reposes on the granite forming the second stratum. The metallic substances found in gneiss are iron, lead, tin, cobalt, copper, and not unfrequently silver.

3. *Micaceous schistus*, or *mica slate*, consists of the same substances with granite and gneiss, only the feldspar is in many instances hardly perceptible, the quartz and mica being arranged in layers, as in gneiss. This substance generally forms the third stratum, but is also met with upon granite itself. Iron, copper, tin, lead, and antimony, are the metals chiefly found in mica slate.

4. *Quartz* is often found separate from mica and feldspar; entire mountains even are composed of it. Little quartz is met with in the southern parts of Britain, but it is common in Scotland, where it may be seen regularly stratified, and in some instances forming the entire materials of high mountains: no metals have yet been found in quartz, though it sometimes affords petroleum or rocktar.

5. *Argillaceous schistus*, also called clay slate, is of the same nature with gneiss and micaceous schistus: but in it the stratification is still more complete, and no traces of crystallized

crystallized granite are to be found. This substance, especially when of a soft texture, is peculiarly rich in metals; lead, copper, sulphur, calamine, are found in it; the great body of copper ore in the Pary's mountain in Anglesey lies under this schistus, and the rich silver mines of Potosi in South America are situated in mountains consisting almost entirely of the same substance.

6. *Jasper* was formerly supposed to be only pure quartz, so far penetrated by some colouring metallic substance as to be deprived of its transparency; but it is now found to consist of flint combined with a quantity of argillaceous matter and iron; it is always opaque, and in colour it varies from red to green.

7. *Hornstone* has by some naturalists been confounded with petrosilex; but they are now distinguished, the former being less pure than the latter, and consisting of the same elements with granite, in which is a large proportion of schorl communicating to the hornstone a dull gray or blackish colour, whereas petrosilex is of a grayish green colour, semi-transparent, and so hard as to give fire when struck with steel.

8. *Pitchstone* is found in large masses of irregular forms and of various colours, as green, red, brown, yellow, appearing sometimes like rosin or glass imperfectly transparent: it is never crystallized.

9. *Hornblende*, or *hornblende slate*, commonly occurs in immense strata; it is also found mixed with quartz, mica, and feldspar: the principal metallic substances found in this slate are copper and iron combined with sulphur.

10. *Serpentine* is a stone similar in respect of its ingredients to those already described. It takes its name from its appearance, being generally of a greenish ground marked with spots, white, yellow, red, or brown, in some sort resembling the skin of a serpent or snake. Rocks of serpentine

tine are found near the Lizard point in Cornwall; and in the Shetland isles are hills chiefly composed of it.

Metals are seldom met with in serpentine, excepting sometimes veins of copper, and an ore of iron which imparts a magnetic power to the stone.

11. *Porphyry* generally consists of the same materials, as granite, but in different proportions, and it has altogether a different appearance, for instead of being crystallized as in granite, the true porphyry is an uniform compact mass, in which are dissiminated small crystals of feldspar, and sometimes of schorl.

Porphyry is very abundant in many situations, forming considerable portions of hills and mountains, particularly between the tropics, as in South America, where it is found at very great heights above the sea. This stone is also every common in most parts of Scotland; on the Calton hill at Edinburgh, it forms a considerable stratum from twelve to fifteen yards in thickness, covering a bed of breccia. Northumberland also affords porphyry in abundance.

In some varieties of porphyry the feldspar, being less durable than the rest of the stone, the blocks become porous; and in these are frequently found ores of silver, copper, iron, lead, antimony.

12. *Puddingstone* and *Breccia.* Between the strata of rocks, and even above the upper stratum, is frequently found a bed of fragments broken off from the principal strata; when these consist chiefly of lime-stone, whether they be rounded or angular, the mass is generally called *breccia*; but when the fragments are of a quartzy or flinty nature, especially if they be agglutinated together into a solid mass, it is from a resemblance to a plumb-pudding, usually termed *puddingstone.* Late geologists, however, have given the name of puddingstone to every mass of rounded fragments or pebbles; and

and that of breccia to such as consist of angular fragments, of whatever nature these fragments may be.

13. *Syenite* is a term lately applied to a compound of grains of feldspar and hornblende, intimately mingled together, and in which the last substance is predominant: the name is borrowed from a stone antiently found at Syene in Upper Egypt, whence it was carried to Rome for erecting public edifices. In Germany veins of silver and lead are found in syenite.

14. *Primitive* or *granular limestone.* It was long doubted whether limestone was ever found unmixed with the remains of organized bodies, that is whether it could be considered as an original or primitive substance; the observations of late geologists, however, have fully proved that primitive limestone does exist in considerable quantities. This stone is of a granular structure, and of a whitish gray colour, though often of a dark iron gray, or reddish brown; it is sometimes scaly or lamellar, at others nearly compact; in some cases it has been found to contain particles of mica and quartz, but it is in general unmixed with any other primary substances. In Germany, Switzerland, the Pyrenees, whole mountains of vast height are chiefly composed of this limestone; it is also seen in extensive masses in the mountains and islands of Scotland.

This limestone often contains metallic ores, in particular magnetic iron, and pyrites, a compound of iron and sulphur.

15. *Primitive trap.*—This term was long employed to signify certain stones of a compact texture and a dark colour, composing part of certain mountains: but as many rocks of very different kinds came to be described as consisting of trap, much confusion has been produced in the writings of geologists of different countries. Primitive trap is almost wholly composed of hornblende, though it is sometimes mixed with feldspar, and more rarely with mica: it is often found in vast layers in the midst of gneiss, and some-

sometimes in granite; this trap frequently contains metals, especially iron and copper.

16. *Topaz rock* is a compound of quartz, schorl, topaz and lithomarga, a kind of hardened clay: of these substances the three former constitute small layers or plates alternating with each other. This stone sometimes contains cavities lined with crystallized quartz and topazes. The topaz rock is very rare: quantities of it are seen in the metallic mountains of axony, but no metals have hitherto been found in it.

17. *Siliceous schistus* or *flinty slate.*—Respecting this stone naturalists have differed as to its being a primitive or only a secondary production; and late geologists are inclined to consider it as formed in the interval of transition from the primary to the secondary state: its colour is bluish gray, internally of a dull slaty appearance, hard, brittle, and transparent on the edges: no metals have been found in it.

Secondly.—The secondary compounds are, secondary limestone, gray wacke, secondary trap, sandstone or grit, gypsum or plasterstone, fluor spar, chalk, clay, argillaceous ironstone, wacke and basalt, rock salt, coal, fossils and petrifactions.

1. *Secondary limestone* is a calcareous mass sometimes granular and sometimes compact, the former approaching to primitive limestones: its fracture is scaly and it is sometimes transparent: its colour is various, red, blackish with white veins of spar, grayish. This substance is at times found in vast blocks without any appearance of stratification; in other cases it is evidently formed in strata. It abounds with the remains of marine animals, and often contains agates and other similar stones. Limestone is also found in egg-shaped balls each usually containing a grain of sand: and one variety of a very porous texture presents frequent remains of vegetable matter, as impressions of leaves, &c.

Secondary limestone is very abundant in most parts of the world

world, forming a considerable part of many mountains, being often the principal stratum to a great depth below the surface. Part of the summit of Mont Perdu, the highest of the Pyrenees, is composed of secondary limestone arranged in nearly vertical strata, and so full of the remains of marine animals, as, in some places, to appear as if consisting of nothing else. The base of Ingleborough in Yorkshire, nearly thirty miles in circuit, consists entirely of limestone, containing vast quantities of sea-shells. Limestone forms the principal inferior strata through the greatest part of Derbyshire, arranged in beds of various thickness, from a few inches to two hundred fathoms, and abounding with shells and other marine remains. This substance is found in many parts of Scotland distinctly stratified.

Secondary limestone often contains metallic veins; in Derbyshire it affords sulphur and copper in the form of pyrites.

The stone usually called *alabaster*, employed in making statues and ornaments of sculpture, is properly a carbonated lime, nearly allied to marble, though it is usually considered to be a variety of gypsum. Limestone alabaster is commonly found in blocks in marble quarries, as in the Greek island Paros, in Tuscany, and some other districts of Italy.

2. *Gray Wacke* consists of fragments of quartz and argillaceous schistus, cemented together by a clayey substance. This stone is distinctly stratified, but the strata are not found to be parallel to those of the other rocks on which they rest; it is commonly observed covering limestone, especially at the foot of hills.

Gray wacke often furnishes slate of a good quality, and it is rich in metals: the greater part of the veins of lead and silver in the Hartz forest, in Germany, lie in gray wacke; in Transylvania it contains rich mines of gold.

3. *Secondary trap.* In secondary strata are found several varieties of trap, all composed of hornblende and feldspar

very

very intimately mixed, the grains of each being so fine that the substance seems to consist of only one material.

4. *Sandstone*, or *grit*. Under these terms are comprehended various sorts of stone, the calcareous, the argillaceous, the siliceous sandstone. In these the component materials are quartz, with a little schistus and feldspar, in the form of small grains cemented together by means of flint, clay, or limestone. The argillaceous standstone is found in immense beds very distinctly stratified and divided by fissures into the shape of a parallelopiped. This is one of the most abundant productions of nature, occurring in almost every country: it usually contains petrifactions in abundance, but seldom affords any metals; cobalt has however been found in it. The siliceous sandstone contains many petrifactions, but no metals have hitherto been discovered in it.

5. *Gypsum*, or *plaster stone*, is a native combination of lime with sulphuric acid, commonly called oil of vitriol, because it was obtained by distillation from that substance. The common gypsum is a compact granulated stone, usually of a grayish colour, containing a quantity of carbonate of lime: its texture resembles coarse loaf sugar. This substance is abundant in many parts: the hill of *Montmartre* rising over the north side of Paris, consists of this gypsum, which is thence, even in this country, usually called *plaster of Paris*. It contains petrifactions, and abounds with the impressions of animal and vegetable substances: copper has been found in it, but in general it produces few metals. Though, from the ordinary form or situation of gypsum and the remains of organised bodies it contains, no doubt can be entertained of its being in most cases a secondary substance; yet from its having in some instances been found mixed with mica, some naturalists have ranked it among the primitive compounds.

6. *Fluor spar*. This beautiful substance is a native compound

pound of lime with a peculiar acid called fluoric acid, is found in large blocks, and also crystallised in cubes or octahedrons; it is of different colours, but the most common varieties are those in parallel bands of green, blue, yellow, and white, or with a white ground veined with a reddish brown. Specimens have occasionally been met with shaded so as to resemble a map. This substance is so soft as to be easily cut and turned in a lathe into vases and other ornaments commonly seen on chimney-pieces and side tables.

Fluor spar is found in many parts of the world: it is not uncommon in France, and in Britain the mines near Castleton, in Derbyshire, are the most productive, whence it is often called Derbyshire marble. The fluor commonly rests upon limestone; and it frequently has limestone for a nucleus or kernel, around which it appears to have crystallized: in some parts of the mine the fluor is found in detached lumps, appearing as if they had been attached to and broken off from some other body. Pieces have now and then been found a foot in thickness, with four or five bands; but such pieces are very rare, the general thickness being three or four inches.

Fluor spar is found in the north of Scotland in mountains of granite, and in the Shetland Isles in a vein of basalt.

7. *Chalk* is usually found in horizontal beds, often many yards in thickness, reposing on layers of other calcareous stone of a harder structure. These beds are often of a great extent, very commonly containing layers of flints and vast quantities of shells.

Chalk, which is so abundant in some countries, is rarely found in some others, as in mountainous countries: thus in Scotland it is very rare, whereas in the southern and south-eastern parts of England it is very common: the south and west of France also afford vast cliffs and beds of chalk. If a line be drawn from Dorchester in Dorsetshire to the county of Norfolk, it will form the boundary of the

great

great chalky stratum of England; very little having ever been found to the westward or northward of such a line.

No metals have ever been met with in chalk, although it be said that martial pyrites, a compound of sulphur and iron, has been discovered in it in France.

8. *Clay* is found in various states with respect to hardness or solidity, from the soft ductile clay employed by potters and pipemakers to the perfect argillaceous schistus or clay slate, already described.

Soft clay is found in beds of various thickness, in common not far below the surface, in alternate strata with harder clay, slate, sand, or limestone: it is in general very abundant, especially in tracts where coal or rock salt is found.

Clay of a harder consistency, called indurated clay, is usually found below the soft, and sometimes a stratum of slate is interposed: petrifactions and shells are often found in it.

A harder state of clay forms lithomarga, or stone clay, which is found in beds alternating with the former or with limestone, especially in coal mines: it sometimes presents the impressions of reeds and other vegetable substances.

The next degree of hardness in clay forms slate clay, and one still harder gives slate or schistus: this is of a dark brown or blackish colour, and of a texture capable of being divided into many laminæ, or thin parallel plates: it is common in coal countries below the sandstone, or alternating with it and limestone: it often bears impressions of organic remains, and sometimes contains lead ore.

Nearly allied to this substance is what the miners call rubble stone, which is a common variety of slate found in similar situations with slate itself, but often very rich in metals, especially iron, bismuth, and cobalt; it also abounds in petrifactions, and is sometimes found in primitive rocks.

9. *Marl*

9. *Marl* consists chiefly of sand, clay, and calcareous matter: it is found in many places, and forms one of the most valuable natural manures used in agriculture: it is of various degrees of solidity, from a soft powder to the consistence of stone: in colour it is generally of a reddish white, but not unfrequently of a yellowish brown or blackish cast. Marl is usually deposited in considerable beds of various degrees of thickness in vallies and other low lands, especially among coal strata.

10. *Argillaceous ironstone.* This is very common in coal countries: it is very compact and heavy, and of various colours from a dark brown to a blood red, the latter forming the hœmatites or bloodstone, one of the richest iron ores: it often contains little spherical bells like bullets. This ironstone is disposed in strata alternating with indurated clay, slate clay, marl, or sandstone, seldom far below the surface; in general it forms beds of small extent, and is often confined to particular spots. Ironstone is found in great abundance in Cumberland, and in the most parts of Scotland; it may be seen laid open all along the cliffs on the greatest part of the coast of Fife.

11. *Wacke* and *basalt.* These substances are very nearly allied to trap, and have been classed with it under the general name of *Whinstone.* Wacke differs from trap only in being more compact and of a finer grain; it is heavy and so hard as often to strike fire with steel: the colour is generally a reddish brown, or a gray of various shades: it often forms a considerable part of mountains, either in vast blocks, as in the hill on which Edinburgh castle is placed, or in strata alternating with limestone or sandstone.

Basalt has a finer grain and is more compact than even wacke, being the densest of all the traps or whinstone; it is found in large blocks covering other strata in the form of tables, or in regular primitive columns, straight or bent. Basalt is the substance composing the beautiful columns

supporting

supporting the surface of Staffa, one of the western isles of Scotland, and its magnificent cave of Fingal; the Giants' Causeway, on the north coast of Ireland, is also a prodigious assemblage of columns of the same kind.

12. *Rock salt*, or *sal gem*, is the purest salt found in nature, being much freer from foreign matter than what is procured from sea-water, It is very hard, generally transparent and sometimes as clear as crystal; it is usually white, but often yellowish blue, red, or violet. This salt forms in the bowels of the earth horizontal beds of various thickness, from a few inches to hundreds of fathoms, and extending for miles around; it commonly alternates with clay or gypsum, and is generally met with at a short distance from the surface, although in some places the bed be continued to the depth of a thousand feet.

Rock salt is found in many districts of Europe, the most remarkable mines are those of Wielitska, in Poland, not far from Cracow, at the northern extremity of a branch of the Carpathian mountains. These veins were opened in 1251, and are supposed to extend above a league from east to west. At Cardona, in the province of Catalonia in Spain, is one of the most extraordinary mines of salt any where to be found: this is one vast solid rock of salt elevated five hundred feet above the adjacent country, and sinking to a depth hitherto unknown: it is without crevices or clefts, and has no appearance of strata; the rock or hill is nearly a mile in circuit.

Rock salt is found in various parts of England, particularly at Northwich in Cheshire, at Droitwich in Worcestershire, and near Weston in Staffordshire; but the mines of Northwich are the most productive. Salt mines in that quarter were known to the Romans, but the principal mine at present wrought was discovered in much later times: in it the salt forms immense quarries, extending under several acres of ground, which, with their huge crystal pillars and glittering

glittering roof, present a most beautiful spectacle. The salt is of a dark brown colour like sugarcandy, and is so hard as to require to be blasted with gunpowder to separate the masses: it is disposed in beds alternating with clay gypsum and slaty stone.

13. *Coal.* The beds in which coal is disposed usually have their extremities nearer the surface of the ground than the middle, which lies horizontally, and in the middle the coal is commonly thickest. A bed of coal is seldom found single, several strata generally occurring at the same spot, of various thickness, the upper stratum usually thin, and the lower very thick, with sundry strong strata between each two strata of coal. At Whitehaven at least twenty different strata of coal have been penetrated in one pit, and in some mines at Liege in the Netherlands, not fewer than sixty strata have been discovered.

The strata separating the beds of coal are nearly the same in all parts: those immediately in contact with the coal are either whinstone, or more commonly an argillaceous slaty mass; near which is sandstone in layers separated by slaty clay mixed with particles of coal. In most cases the slaty strata bear the impressions of vegetables, and often of such as are natives of countries very remote from that where the coal is found.

Coal is found more or less in most parts of the world, and probably exists in all; but Britain and France may be considered as the most plentifully supplied with this invaluable production of nature, which may justly be put in competition with the treasures of Peru. The principal coal mines in England are those of Newcastle and Whitehaven. Newcastle is surrounded by these mines to the distance of eighteen or twenty miles, and may perhaps be considered as the richest coal tract in Europe. In several of these mines are not fewer than sixteen beds of coal, of which two are about six feet each in thickness. Good coal at New-

castle is generally found in sufficient quantity at a depth of one hundred feet. At Whitehaven the coal lies in parallel beds, dipping to the westward one yard in ten or twelve: in a depth of 165 fathoms are found seven thick beds of coal and eighteen thin beds. The similarity of the situation and the nature of the coal at Newcastle and Whitehaven, lead to believe that at both places it is drawn from the same great body of coal; and this is placed beyond a doubt by a comparison of the various successive strata through which the pits in each district have been sunk.

There appear to be two principal beds of coal in Britain, stretching from the eastern to the western coast, the one in England from Newcastle to Whitehaven, and the other in Scotland, along the vales watered by the Forth and the Clyde. Coal is indeed found in many other parts of the island, but in a comparatively small quantity.

Pit-coal consists of asphaltum or petroleum (rock tar) intimately mixed with a small portion of earth, chiefly clayey, seldom calcareous, and frequently mixed with pyrites, (a combination of iron and sulphur), and unless in the form of pyrites, sulphur has never been found in pit-coal.

Of coal there are various sorts besides pit-coal, such as culm, slate-coal, cannel-coal, which is of a dull black colour, breaking easily in all directions in a smooth conchoidal surface: it burns with a bright lively flame, but is very apt to fly off in splinters: this property may however, it is said, be removed by steeping the coal in water for some hours before it be used: it contains a considerable quantity of asphaltum in a less condensed state than other coal. Cannel coal being of an uniform hard texture is easily turned in a lathe, it takes a good polish, and does not soil the fingers, whence it is used in making snuff-boxes and other toys, which have the appearance of jet. At Kilkenny in Ireland, is found a coal of a peculiar quality; it contains more as-

phaltum

phaltum than any other, it burns with less smoke and flame, and more intensely though less slowly than the cannel coal: the quantity of earth it contains amounts only to about one-twentieth part of its weight, but it is frequently mixed with pyrites. Coal of a similar quality has also been discovered in the county of Fife.

For exciting intense heats, as for the smelting of iron ore, and for operations where the acid and oily particles would be detrimental, as in drying malt, pit-coal is previously charred, that is, made to undergo a process similar to that by which wood is converted into charcoal: pit-coal in this state is called coke or coak. By this operation the coal is deprived of its phlegm and liquor, and part of its oil: the coke therefore consists of the heavy oil and the earth.

By converting coal into coke, in ovens prepared for the purpose, the volatile alkali oil tar and pitch, which, in the common process, are lost in the open air, are collected in different receptacles, for many important uses in life.

14. *Fossils* and *Petrifactions*. The remains of animal and vegetable substances found below the surface, and mixed with the stony matter properly forming the body of the earth, are termed fossils, a name merely expressive of their being dug out of the ground: but when all traces of vegetable or animal substances have disappeared, and nothing but the stony matter remains, these fossils are more properly termed petrifactions, or substances converted into stone.

Of these fossil bodies it is remarkable that they are frequently natives of countries very remote from that in which they are discovered, and that amongst them few or none of the natives of the tract where they are found are met with. In the hills in the vicinity of Verona, in the north of Italy, are found petrified fish of kinds found only in the Asiatic seas, while those of the neighbouring Gulf of Venice are comparatively rare.

Of Metallic Veins.

From the beauty and splendour of some metallic substances, and the universal utility of others, they have in all ages been highly esteemed, and sought after with the most eager research. Metals are distinguished from other substances chiefly by these properties: their brilliancy, colour, opacity, density, hardness, elasticity, ductility, malleability, tenacity, fusibility, power of conducting heat and electricity.

The metals are reckoned the following, arranged according to their density and weight.

1. *Platina.* This name is given by the Spaniards of South America, from its resemblance to silver (*plata* signifying *silver* in the Spanish language) to a substance met with in the province of New Grenada: it has hitherto been found only in a metallic or native state in the sand of torrents, drawn down probably from the primitive mountains.

2. *Gold* is found chiefly in primitive mountains, sometimes in veins and sometimes distributed through the stony matter. The substances most commonly accompanying gold are quartz, feldspar, calcareous spar, pyrites, red and vitreous silver ore, and lead; but it is found more frequently in the sand of rivers. The countries where gold is discovered in the greatest abundance are Transylvania Hungary and Sweden in Europe, Siberia in Asia, Peru and Mexico in America: what is drawn from Africa is the produce of the sands of torrents and rivers.

Gold has been found in different parts of the British islands, as at Silsoe in Bedfordshire, in the Lead hills in Lanarkshire in Scotland, and on the Wicklow hills not far from Dublin in Ireland. This last mine is now in the hands of Government; but does not answer the expectation at first formed of its value.

In the reign of James the Vth of Scotland, who died in 1542, many persons were employed in washing the sand of the

the brooks near Lead-hills, to separate the gold particles, which, in the course of some seasons, amounted to a very considerable value: pieces exceeding an ounce in weight have been found in that neighbourhood.

3. *Mercury*, or *Quicksilver*, is found in various states; native mercury is met with in cavities or clefts of rocks, in strata of clay or chalk, in the form of fluid globules: it is also found combined or amalgamated with silver: mercury is likewise discovered mineralised with sulphur; when this combination is of a bright scarlet colour it is called cinnabar, or vermilion.

Mercury is found in parts of Germany and Hungary, but the richest mines are those of Almaden in the south of Spain.

4. *Silver*, in its native state, is found in considerable quantities in Mexico and Peru: it is also met with in Siberia, Saxony, Sweden, Norway, Bohemia, France, chiefly in primitive mountains, amidst masses of spar, quartz, lead ore. Silver is likewise met with combined with antimony and with arsenic, of which last combination is the silver drawn from the lead mines in the south of Scotland.

5. *Copper* appears in many various states, of which the most common is the yellow pyrites, and is met with in both primitive and secondary mountains, sometimes in beds, at others in veins: in Britain this is the principal variety of copper ore, particularly in the noted Pary's mine in Anglesea.

6. *Iron*. This metal, in a native state, is extremely rare; one of the most common ores of iron is the martial pyrites. One of the richest ores is the hæmatites, or bloodstone, found in many parts of Britain, especially at Ulverstone in Lancashire, whence large quantities are carried to the great works at Carron in Scotland, to be smelted with the common ironstone of that country. The magnet is an iron ore generally found in primitive mountains, especially those

composed

composed of gneiss and micaceous schistus: the magnet is also found in the form of sand on the banks of certain rivers, as the Elbe in Germany, and in Sweden and Italy.

7. *Lead.* This metal is most commonly found in both primitive and secondary strata, in beds and veins, with quartz, fluor spar, sparry iron ore, pyrites, and various sorts of silver ore. This ore is procured from the Mendip hills in Somersetshire, from Derbyshire, and in great abundance from the Lead-hills in Dumfriesshire, Scotland.

Lead ores are of various colours, blue, brown, black, white, green, red, yellow: the black ore, also called plumbago, employed to make pencils, is found in Cumberland and Scotland.

8. *Tin.* The common tinstone is found chiefly in primitive rocks, as in granite, gneiss, micaceous schistus, and porphyry, both in masses and veins: this is the ordinary tin-ore of Cornwall, and is also procured from the rivers of Saxony, Bohemia, and the East Indies. A species called tin pyrites is very rare, being hitherto found only in Cornwall among copper pyrites.

9. *Bismuth* is a very rare metal, and is usually found in a pure native state in quartz and spar: it is met with in Flanders, Saxony, Sweden, and in the mines of Brittany in France.

10. *Zinc.* One of the most common ores of zinc is a combination with sulphur of various colours: it is the production of Saxony, Bohemia, Norway, Hungary; it is also met with in France and in Derbyshire.

Calamine is a variety of zinc, found in stratified rocks, often forming entire beds, with indurated clay and calcareous spar: this species occurs in the German lead mines, also in Derbyshire, and the lead mines of the south of Scotland.

11. *Antimony* has been discovered, but very rarely, in a native state, but the most common ore is combined with sulphur,

sulphur, and is the produce of most European countries.

12. *Cobalt.* The common ore of this metal is of a bright shining white colour, and is generally found with the ores of silver and nickel: it is met with in beds in primitive rocks, and in veins in those of a secondary composition: it is found in most parts of Europe.

13. *Nickel.* This metal, combined with sulphur, is found in veins generally accompanying ores of cobalt, to which it seems to have a near relation; it is produced in Britain as well as on the continent.

14. *Manganese* is discovered in veins and masses, commonly in primitive mountains; the ore is generally of a gray colour, and sometimes red. Manganese is met with in the Mendip hills and at the lead mines in Scotland.

15. *Molybdena* is found in primitive rocks, in particular in tin mines, in Saxony, Sweden, France, and at the foot of Mont Blanc.

16. *Arsenic* is found in a native state in many parts of the continent, in veins of primitive mountains, accompanied by ores of lead, cobalt and silver.

The *Marcasite* is a compound of arsenic and pyrites, met with accompanying tinstone and some other minerals.

Realgar and *Orpiment* are also varieties of arsenic, found in many parts of the continent, and in the neighbourhood of the volcanoes Etna and Vesuvius.

17. *Tungsten* and *Wolfram*; 18. *Uranium*; 19. *Titanium*; 20. *Tellurium*: these are metals lately discovered, of whose nature and uses little is hitherto known.

OF EARTHQUAKES.

VARIOUS opinions have been formed, and various hypotheses proposed, to account for earthquakes, by both the antients

anticnts and the moderns; but the most satisfactory mode of explaining these dreadful phœnomena of nature has hitherto been to do it on the principles of electricity; and various experiments have been instituted, in which the electric fluid has been made to produce effects of the same kind with those occasioned by earthquakes. It is, however, certain that in earthquakes appearances present themselves, and facts are observed, which cannot be explained according to any one theory of those adopted for their solution; it is therefore not unphilosophical to suppose that many causes may be combined in their production.

Earthquakes have been felt in most countries of the globe; there are, however, particular places seemingly more subject than others to their ravages. It may be observed, in general, that earthquakes are more frequent within the tropics; but there are spots even in that region more rarely visited by this dreadful calamity than others in the temperate or even the colder tracts of the earth. In the islands in the West Indies, and in some parts of the continent of America, within the torrid zone, earthquakes are more frequent than in most other quarters of the globe: but Italy, Sicily, Portugal, and some other spots without the tropics have been oftener exposed to the devastations of those concussions than many islands and tracts lying within the tropics. Of all the West India islands Jamaica has suffered the most frequently and the most severely; while Mexico and Peru are more subject to earthquakes than any other regions of the American continent. Portugal has in a manner been shaken to its foundation, while Spain, of which Portugal is naturally a portion, is comparatively free from such disasters.

Observations on phœnomena so awful and so destructive, can scarcely be very numerous or correct; the operation of their causes is too rapid, the effects are too sudden and unexpected, to be the subjects of cool and attentive investigation;

tion; or rather to say the truth, they are too extensive and too obscure for the human powers to comprehend.

Earthquakes are most common in volcanic countries: where a volcanoe exists, and when for a considerable time it has intermitted its customary discharges of inflammable matters, shocks of earthquakes begin to be dreaded: this is so regularly the case, that an earthquake in such a situation and circumstances is frequently the forerunner of an explosion of the volcanoe.

Earthquakes are often preceded by long drought: they do not, however, immediately follow the cessation of dry weather or the fall of rain: electrical appearances are observed in the air before the concussion is perceived: the aurora borealis is frequent and brilliant, and bright meteors are often seen to dart from one quarter of the heavens to another, or between the air and the earth. Before the shock comes on, the sea is unusually troubled, without any visible cause, swelling up with great noise in the midst of a profound calm. On land fountains and springs are greatly agitated: the air at the instant of the concussion has been observed to be particularly calm and serene, but afterwards it became cloudy and dark.

The noise accompanying an earthquake sometimes resembles that of a number of carriages driving along the pavement of a street with great rapidity: at other times the noise is like a violent rushing wind, or the explosion of numerous artillery.

The effects of earthquakes on the surface of the earth are various: at one time the surface is instantaneously heaved up perpendicularly, at another it assumes a kind of rolling motion from side to side; great openings or fissures are made in the ground, generally throwing out vast quantities of water with fire and smoke; these last are often emitted where no fissure is perceptible. On the ocean the earthquake is often not less terrible than on the land; the sea

swells up to a great height; its waters seem to be entirely separated, and from the place of separation currents of air smoke aud flame are discharged. Similar effects have been observed on lakes, ponds and rivers.

The duration of a shock rarely exceeds a minute, and perhaps very few have continued nearly so long: but the shocks often follow each other in rapid succession, and from the dread and terror excited in the minds of persons exposed to their ravages, their duration may appear far to exceed the truth.

History, antient and modern, is full of the disasters occasioned by earthquakes. In June 1690, the town of Port Royal, at the entrance of Kingston harbour, in Jamaica, was almost entirely overthrown by an earthquake, and swallowed up in the sea. On the 1st of November 1755, came on at Lisbon, a concussion of the earth, which for its extent was one of the most extraordinary on record: in the course of six minutes the greater part of that great capital was levelled with the ground, and thousands of the inhabitants buried under the ruins: the bed of the river Tagus in some places heaved up to the surface of the water: the bar at the entrance of the river was for a time dry from shore to shore; in another part the water rose instantaneously to the height of fifty feet.

A very singular circumstance attending this earthquake was the prodigious extent in which its effects were more or less sensible: all over Portugal and Spain shocks were felt, even at Madeira the earth was sensibly agitated, and the sea rose suddenly fifteen feet above its usual height. In Corsica, at Milan and Turin in Italy, the earthquake was evidently observed. In Britain, Norway, and Sweden, the rivers and lakes were powerfully agitated. Ships out in the Atlantic ocean felt a sudden commotion in the waters, as if they had struck upon a rock.

One of the most calamitous earthquakes of which we have any

any accurate account, was that which visited Calabria, in the south of Italy, in 1783. Of this event it has been observed, that if round the town of Oppido as a centre, with a radius of twenty-two miles, a circle were described on a map of Italy, it would comprehend all the towns, villages, castles, &c. which were utterly destroyed, with the spots where the greatest mortality prevailed, and where happened the most sensible alterations on the surface: again, a circle described round the same centre, with a radius of seventy-two miles, would inclose the whole country in any way visibly affected by that earthquake.

Britain has of late years shewn symptoms of earthquakes, feeble indeed and unimportant, but unequivocal and alarming. In a tract surrounding the village of Comrie, in the county of Perth, in Scotland, at different periods, noises and slight concussions have been perceived; and in the three last months of 1790, these were so considerable as to attract the general attention of the country, not only the earth but the lakes and rivers being very sensibly agitated.

Of Volcanoes.

Burning mountains or volcanoes are found in almost every part of the globe. Hecla in Iceland, and a volcanoe in Tierra del Fuego, at the extremity of South America, occupy the limits of the known world. The numbers of volcanoes at present known is about a hundred: those of Europe are well known, Hecla already mentioned, Vesuvius in the vicinity of Naples, and Etna in Sicily; to these must be added the volcanoes in the Lipari islands on the north of Sicily.

Volcanoes always appear in the summits of mountains, none having yet been found in the midst of plains; the existence of volcanoes in the bottom of the ocean is no

 exception,

exception, for these are also in the highest points of hills under water.

Volcanic eruptions have been ascribed to the action of the waters of the sea breaking in upon an immense quantity of melted or burning matter, to that of fires in the bowels of the earth, and to the decomposition of different substances, by which great quantities of inflammation and heat are produced.

The first symptom of an eruption is the increase of the smoke in fair weather; this is of a whitish colour, but after some time black smoke is sent up in the midst of the white column. These appearances are usually accompanied by explosions; and the black smoke is followed by a reddish flame. Showers of inflamed stones are next thrown up of a great size and to a prodigious height. During the eruption of Vesuvius, in the beginning of 1792, inflamed masses of rock were projected to a height of two thousand feet above the mountain top, and were distinctly visible in the night from a distance of nine miles. Along with the stones clouds of ashes are also emitted and carried by the winds to very great distances. These appearances, which daily increase in frequency and violence, are generally preceded and accompanied by earthquakes and hollow noises from the bowels of the earth.

The smoke rising from the mouth or *crater* of the volcano (so called because it resembles a cup or funnel) is observed to be highly electrical; flashes of lightning dart in zig-zags through the column, often attended by thunder; at last the lava begins to flow. The *lava* is a current of melted matters, sometimes boiling over at the top, and often when the mountain is very high, as at Mount Etna, breaking out at the side and flowing down to the bottom. At its first discharge lava is in a state of most intense ignition, greatly superior to any thing that can be produced in our diminutive furnaces. The lava proceeding from Vesuvius had the appearance

appearance of a river of red-hot and liquid metal, such as is seen in a glass-house, on which floated large masses of cinder half-lighted, rolling over one another down the mountain side, and forming a most magnificent cascade. When we consider the materials of which lava consists, which are the common substances found in the earth, namely, stones, metallic ores, clay, &c. we may form some notion of the intense heat within a volcanoe; for such materials cannot, by the most powerful furnaces, be brought to fusion without the addition of very fusible salts, such as alcali, nitre, &c.

Currents or rivers of lava on the slopes of Etna have been measured from fifteen to twenty miles in length, six or seven miles in breadth, and fifty feet in depth: the lavas from Vesuvius, a mountain far less elevated, extend six or seven miles from the summit, some of them above a mile in breadth, on a general depth of sixty or seventy feet.

The lavas of Etna and Vesuvius take a fine polish, and are frequently manufactured into boxes, tables, &c.: in the British Museum are several capital specimens of lava, in both its natural and its polished state.

The streets of Naples are in general paved with polygonal pieces of lava, perhaps in imitation of the magnificent road opened from Rome to Capua, by the Censor Appius Claudius, about 312 years before the Christian æra, in many parts of which the antient pavement of lava is observable, still very entire, consisting of pieces of five, six, or seven sides, and from twelve to twenty-four inches in diameter. The lately uncovered town of Pompeii is supposed to have been overwhelmed by ashes from Vesuvius, about the year 79 of the Christian æra, during an irruption in which Pliny the elder perished, from his eagerness to observe and understand the phœnomena, and which is so characteristically described to us in an epistle from his nephew to Tacitus the historian. At one of the gates of this most interesting town are seen

deep

deep ruts worn by carriage wheels, in a pavement of very compact lava. So little was the nature of the pavement of the Appian way known, in the latter times of the Roman empire, that Procopius, who flourished under Justinian about A. D. 560, conjectures that the stones were drawn from some quarter very remote from Italy, because no quarries of a similar substance were then known in that country.

To form a proper theory of the earth, it is necessary to trace the series of those revolutions which have occurred on its surface, to explain their causes, and so to connect together all the indications of change that are found in the mineral kingdom. The formation of such a theory, therefore, requires an accurate and extensive examination of the phœnomena of geology, and it supposes natural knowledge to have attained a very high degree of improvement. In science there is perhaps no research more arduous than this, none where the subject is so complex, where the appearances of objects are so greatly diversified, or so widely distributed, where the operating causes are so remote from the sphere of ordinary observation.

With such requisites and under such difficulties, it is not surprising that so many ingenious men who have attempted to construct theories of the earth should have failed: to form such a theory requires a prodigious accumulation of facts, together with a talent for observation and arrangement, seldom united in any one individual. We are not, however, to suppose that a correct theory is inattainable, although some may think it an arrogant and presumptuous undertaking to aim at explaining how the present state of the globe, and the revolutions it has undergone, have been produced.

In

In constructing a theory of the earth, certain laws ought to be inviolably observed. No effect should be attributed to any cause whose known properties are inadequate to its production. No cause should be adduced whose existence is not proved by either actual experience or approved testimony: many natural phœnomena have arisen and do arise in times and places so distant, that well-conditioned testimony concerning them cannot, without absurdity, be rejected: thus the inhabitants of the northern parts of Europe, who have never felt earthquakes nor seen volcanoes, must, nevertheless, from testimony, admit that earthquakes have happened, and that volcanoes do exist. Lastly, no powers should be ascribed to an alleged cause which actual experience has not shown it, in appropriated circumstances, to possess.

It is not a little curious that of the framers of theories and systems for explaining the appearances of the earth, by far the greater number have been natives of Britain; Burnet, Woodward, Whiston, Whitehurst, Hutton, have in this island exerted their faculties in similar enterprises with various degrees of success; while, with the exceptions of Buffon in France and Werner in Germany, the continental naturalists have, perhaps more usefully, confined their pursuits to the ascertainment and classification of the facts and appearances of natural objects around them.

Theorists have been classed under the appellations Neptunians and Vulcanians, according to their leading principles in explaining natural phœnomena; the former supposing the present state of things to have been brought into effect by the action of water, and the latter attributing the same effects to the action of fire. In this seems to consist the chief error of all theorists; for it is impossible to explain every phœnomenon from the agency of any one of these powerful agents: and although we have no account, historical or traditional, of any great change being produced in the

the state of our globe, excepting by the deluge or flood in the time of Noah, about 1656 years after the creation; yet many very great and important alterations may have been produced by the operation of volcanoes and other internal fires in various parts of the earth, which it was foreign to the scope of the Mosaic history to record, had those changes even fallen under the observation of the sacred historian, or of the predecessors from whose informations his accounts were composed.

THE

ELEMENTS

OF

MORAL PHILOSOPHY.

BOOK I.

HUMAN knowledge has been distributed by philosophers into different branches, and into more or fewer divisions, according to the more or less extensive views which they have taken of the various subjects of human inquiry.

Partition of knowledge.

A great philosopher * has laid it out into three general provinces, history, poetry, and philosophy; which he refers to three several powers of the mind, memory, imagination, and reason. Memory stores up facts, or ideas, which are the materials of knowledge. Imagination ranges and combines them into different assemblages or pictures. Reason observes their differences, connections, and mutual relations, and argues concerning them.

Philosophy in general.

The last is the proper business of philosophy, which has been defined the "knowledge of whatever exists," or the "science of things human and divine." According to this definition, its object comprehends the universe, or whole of things. It traces whatever

* Vid. Bacon. Aug. Scient. lib. II. cap. 1.

ever can be known by man concerning the Deity and his works, their natures, powers, operations, and connections.

Division of philosophy. Therefore, to give our definition more precision, philosophy may be defined, the knowledge of the universe, or of nature, and of its powers, operations, and connections, with just reasonings deduced from thence. Natural. Natural philosophy investigates the properties and operations of body or matter. Moral. Moral philosophy contemplates human nature, its moral powers and connections, and from these deduces the laws of action; and is defined more strictly the "science of manners or duty, which it traces from man's nature and condition, and shews to terminate in his happiness." Therefore it is called *Ethics*, *disciplina morum.* In fewer words, it is the "knowledge of our duty and felicity, or the art of being virtuous and happy."

How an art. It is denominated an art, as it contains a system of rules for becoming virtuous and happy. Whoever practises these rules, by so doing, attains an habitual power and facility of becoming virtuous and happy. How a science. It is likewise called a science, as it deduces those rules from the principles and connections of our nature, and proves that the observance of them is productive of our happiness.

It is an art, and a science of the highest dignity, importance, and use. Its object. Its object is man's duty, or his conduct in the several moral capacities and connections which he sustains. Its office. Its office is to direct that conduct, to shew whence our obligations arise, and where they terminate. Its end. Its use, or end, is the attainment of happiness; Its means. and the means it employs are rules for the right conduct of our moral powers.

As

The standard of other arts and sciences.

As every art and science is more or less valuable as it contributes more or less to our happiness, this moral art or science, which unfolds our duty and happiness, must be a proper canon or standard, by which the dignity and importance of every other art and science are to be ascertained. It is therefore pre-eminent above all others; it is that master-art, that master-science, which weighs their respective merit, adjusts their rank in the scale of science, prescribes their measure, and superintends their efficacy and application in human life. Therefore moral philosophy has been honoured with the glorious epithets of the directress of life, the mistress of manners, the inventress of laws and culture, the guide to virtue and happiness, without some degree of which man were a savage, and his life a scene of barbarity and wretchedness.

The method.

Having thus settled the subject and end of the science, the elements of which we are attempting to discover, and sufficiently distinguished it from all others, it seems proper next to fix the method of prosecuting it. Moral philosophy has this in common with natural philosophy, that it appeals to nature or fact; depends on observation; and builds its reasonings on plain uncontroverted experiments, or upon the fullest induction of particulars of which the subject will admit. We must observe, in both these sciences, *Quid faciat & ferat natura*; how nature is affected, and what her conduct is in such and such circumstances. Or, in other words, we must collect the phenomena, or appearances of nature, in any given instance; trace these to some general principles or laws of operation; and then apply these principles or laws to the explaining of other phenomena.

Therefore moral philosophy inquires, not how man might have been, but how he is constituted; not into what principles or dispositions his actions may be artfully

resolved, but from what principles and dispositions they actually flow; not what he may, by education, habit, or foreign influence, come to be, or do, but what by his nature, or original constituent principles, he is formed to be and do. We discover the office, use, or destination of any work, whether natural or artificial, by observing its structure, the parts of which it consists, their connection or joint action. It is thus we understand the office and use of a watch, a plant, an eye, or hand. It is the same with a living creature, of the rational or brute kind. Therefore to determine the office, duty, or destination of man, or, in other words, what his business is, or what conduct he is obliged to pursue, we must inspect his constitution, take every part to pieces, examine their mutual relations one to the other, and the common effort or tendency of the whole.

SECTION I.

Of Man and his Connections.

IN giving a rude sketch or history in miniature of man, we must remember that he rises from small beginnings, unfolds his faculties and dispositions by degrees, as the purposes of life require their appearance, advances slowly through different stages to maturity, and, when he has reached it, gradually declines till he sinks into the grave. Let us accompany him in his progress through these successive stages, and mark the principles which actuate, and the fortunes which attend him in each, that we may have a full view of him.

Man's infant state.

Man is born a weak, helpless, delicate creature, unprovided with food, cloathing, and whatever else is necessary for subsistence or defence. And

And yet, exposed as the infant is to numberless wants and dangers, he is utterly incapable of supplying the former, or securing himself against the latter. But, though thus feeble and exposed, he finds immediate and sure resources in the affection and care of his parents, who refuse no labours, and forego no dangers, to nurse and rear up the tender babe. By these powerful instincts, as by some mighty chain, does nature link the parent to the child, and form the strongest moral connection on his part, before the child has the least apprehension of it. Hunger and thirst, with all the sensations that accompany or are connected with them, explain themselves by a language strongly expressive, and irresistibly moving. As the several senses bring in notices and informations of surrounding objects, we may perceive in the young spectator early signs of a growing wonder and admiration. Bright objects and striking sounds are beheld and heard with a sort of commotion and surprise. But, without resting on any, he eagerly passes on from object to object, still pleased with whatever is most new. Thus the love of novelty is formed, and the passion of wonder kept awake. By degrees he comes acquainted with the most familiar objects, his parents, his brethren, and those of the family who are most conversant with him. He contracts a fondness for them, is uneasy when they are gone, and charmed to see them again. These feelings become the foundation of a moral attachment on his side, and by this reciprocal sympathy he forms the domestic alliance with his parents, brethren, and other members of the family. Hence he becomes interested in their concerns, and feels joy or grief, hope or fear on their account, as well as his own. As his affections now point beyond himself to others, he is denominated a good or ill creature, as he stands well or ill affected to them. These then are the first links of the moral chain, the early rudiments,

ments, or outlines of his character, his first rude essays towards agency, freedom, manhood.

His childhood.

When he begins to make excursions from the nursery, and extends his acquaintance abroad, he forms a little circle of companions, engages with them in play, or in quest of adventures, and leads, or is led by them, as his genius is more or less aspiring. Though this is properly the season in which appetite and passion have the ascendant, yet his imagination and intellectual powers open apace; and as the various images of things pass before the mental eye, he forms a variety of tastes; relishes some things, and dislikes others, as his parents, companions, and a thousand other circumstances, lead him to combine agreeable or disagreeable sets of ideas, or represent to him objects in alluring or odious lights.

As his views are enlarged, his active and social powers expand themselves in proportion; the love of action, of imitation, and of praise, emulation, curiosity, docility, a passion for command, and fondness of change. His passions are quick, variable, and pliant to every impression; his attachments and disgusts quickly succeed each other. He compares things, distinguishes actions, judges of characters, and loves or hates them, as they appear well or ill affected to himself, or to those he holds dear. Mean while he soon grows sensible of the consequences of his own actions, as they attract applause, or bring contempt; he triumphs in the former, and is ashamed of the latter; wants to hide them, and blushes when they are discovered. By means of these powers he becomes a fit subject of culture, the moral tie is drawn closer, he feels that he is accountable for his conduct to others as well as to himself, and thus is gradually ripening for society and action.

His youth.

As man advances from childhood to youth, his

his passions as well as perceptions take a more extensive range. New senses of pleasure invite him to new pursuits; he grows sensible to the attractions of beauty, feels a peculiar sympathy with the sex, and forms a more tender kind of attachment than he has yet experienced. This becomes the cement of a new moral relation, and gives a softer turn to his passions and behaviour. In this turbulent period he enters more deeply into a relish of friendship, company, exercises, and diversions; the love of truth, of imitation, and of design, grows upon him; and as his connections spread among his neighbours, fellow citizens, and countrymen, his thirst of praise, emulation, and social affections grow more intense and active. Mean while, it is impossible for him to have lived thus long without having become sensible of those more august signatures of order, wisdom, and goodness, which are stamped on the visible creation; and of those strong suggestions within himself of a parent-mind, the source of all intelligence and beauty; an object as well as source of that activity, and those aspirations which sometimes rouze his inmost frame, and carry him out of himself to an almighty and all-governing power: hence arise those sentiments of reverence, and those affections of gratitude, resignation, and love, which link the soul with the author of nature, and form that most sublime and god-like of all connections.

His manhood.

Man having now reached his prime, either new passions succeed, or the old set are wound up to an higher pitch. For, growing more sensible of his connections with the public, and that particular community to which he more immediately belongs; and taking withal a larger prospect of human life, and its various wants and enjoyments; he forms more intimate friendships, grasps at power, courts honour, lays down cooler plans of interest, and becomes more attentive to the concerns

cerns of society; he enters into family connections, and indulges those charities which arise from thence. The reigning passions of this period powerfully prompt him to provide for the decays of life; and in it compassion and gratitude exert their influence in urging the man, now in full vigour, to requite the affection and care of his parents, by supplying their wants and alleviating their infirmities.

Old age. At length human life verges downwards; and old age creeps on apace, with its anxiety, love of ease, interestedness, fearfulness, foresight, and love of offspring. The experience of the aged is formed to direct, and their coolness to temper, the heat of youth; the former teaches them to look back on past follies, and the latter to look forward into the consequences of things, and provide against the worst*. Thus every age has its peculiar genius and set of passions corresponding to that period, and most conducive to the prosperity of the rest. And thus are the wants of one period supplied by the capacities of another, and the weaknesses of one age tally to the passions of another.

Passions of every age. Besides these, there are other passions and affections of a less ambulatory nature, not peculiar to one period, but belonging to every age, and acting more or less in every breast throughout life. Such are self-love, benevolence, love of life, honour, shame, hope, fear, desire, aversion, joy, sorrow, anger, and the like. The two first are affections of a cooler strain, one pointing to the good of the individual, the other to that of the species; joy and sorrow, hope and fear, seem to be only modifications, or different exertions, of the same original affections of love and hatred, desire and aversion, arising from the different circumstances or position of the object desired or abhorred, as it is present or absent.

* See Hor. de Art. Poet.

From

From these likewise arise other secondary or occasional passions, which depend, as to their existence and several degrees, upon the original affections being gratified or disappointed, as anger, complacence, confidence, jealousy, love, hatred, dejection, exultation, contentment, disgust, which do not form leading passions, but rather hold of them.

Their joint effects.

By these simple but powerful springs, whether periodical or fixed, the life of man, weak and indigent as he is, is preserved and secured, and the creature is prompted to a constant round of action, even to supply his own numerous and ever-returning wants, and to guard against the various dangers and evils to which he is obnoxious. By these links men are connected with each other, formed into families, drawn into particular communities, and all united as by a common league into one system or body, whose members feel and sympathize one with another. By this admirable adjustment of the constitution of man to his state, and the gradual evolution of his powers, order is maintained, society upheld, and human life filled with that variety of passion and action which at once enliven and diversify it.

The directing power.

This is a short sketch of the principal movements of the human mind. Yet, these movements are not the whole of man; they impel to action, but do not direct it; they need a regulator to guide their motions, to measure and apply their forces: and accordingly they have one that naturally superintends and directs their action. We are conscious of a principle within us, which examines, compares, and weighs things, notes the differences, observes the forces, and foresees the consequences of affections and actions. By this power we look back on past times, and forward into futurity, gather experiences, estimate the real and comparative value of objects, lay out schemes, contrive means to execute them,

and

and settle the whole order and œconomy of life. This power we commonly distinguish by the name of reason or reflection, the business of which is not to suggest any original notices or sensations, but to canvass, range, and make deductions from them.

The judging or approving powers.

We are intimately conscious of another principle within us, which approves of certain sentiments, passions, and actions, and disapproves of their contraries. In consequence of the decisions of this inward judge, we denominate some actions and principles of conduct right, honest, good, and others wrong, dishonest, ill. The former excite our esteem, moral complacence, and affection, immediately and originally of themselves, without regard to their consequences, and whether they affect our interest or not. The latter do as naturally and necessarily call forth our contempt, scorn, and aversion. That power by which we perceive this difference in affections and actions, and feel a consequent relish or dislike, is commonly called conscience, or the moral sense. Whether such a power belongs to human nature or not, must be referred to every one's experience of what passes within himself.

These powers different from affections.

These two powers of reason and conscience are evidently principles different in nature and kind from the passions and affections. For the passions are mere force or power, blind impulses, acting violently and without choice, and ultimately tending each to their respective objects, without regard to the interest of the others, or of the whole system. Whereas the directing and judging powers distinguish and ascertain the different forces, mutual proportions and relations, which the passions bear to each other and to the whole; recognize their several degrees of merit, and judge of the whole temper and conduct, as they respect either the individual or the species; and are capable of directing or restraining the

the blind impulses of passion in a due consistency one with the other, and a regular subordination to the whole system.—Let this difference be remembered.

Division of the passions.

This is some account of the constituent principles of our nature, which, according to their different mixtures, degrees, and proportions, mould our character and sway our conduct in life. In reviewing that large train of affections which fill up the different stages of human life, we perceive this obvious distinction among them; that some of them respect the good of the individual, and others carry us beyond ourselves to the good of the species or kind. The former have therefore been called private, and the latter public affections. Of the first sort are love of life, of pleasure, of power, and the like. Of the last are compassion, gratitude, friendship, natural affection, and the like. Of the private passions *, some respect merely the security and defence of the creature, such as resentment and fear: whereas others aim at some positive advantage or good, as wealth, ease, fame. The former sort therefore, because of this difference of objects, may be termed defensive passions. These answer to our dangers, and prompt us to avoid them if we can, or boldly to encounter them when we cannot.

Defensive passions.

Private or appetitive passions.

The other class of private passions, which pursue private positive good, may be called appetitive. However, we shall still retain the name of private, in contradistinction to the defensive passions. Man has a great variety of wants to supply, and is capable of many enjoyments, according to the several periods of his life, and the different situations in which he is placed. To these therefore a suitable train of private passions cor-

* Here we use passions and affections without distinction. Their difference will be marked afterwards.

respond, which engage him in the pursuit of whatever is necessary for his subsistence or welfare.

Public passions. Our public or social affections are adapted to the several social connections and relations which we bear to others, by making us sensible of their dangers, and interesting us in their wants, and so prompting us to secure them against one and supply the other.

The appeal. Whether this historic draught of man, and of that group of figures and connections with which he is environed, be just or not, is a matter not so much of reasoning as common sense and common experience. Therefore let every one consult his experience of what he feels within, and his knowledge of what is transacted abroad, in the little or the great world in which he lives; and by that experience, and that knowledge, let the picture be acknowledged just, or pronounced the contrary: for to that experience, and to that knowledge, and to these alone, the designer appeals.

This is the first step then to discover the duty and destination of man, the having analysed the principles of which he is composed. It is necessary, in the next place, to consider in what order, proportion, and measure of those inward principles, virtue, or a sound moral temper, and right conduct consists; that we may discover whence moral obligation arises.

SECTION II.

Of Duty or Moral Obligation.

The measure of powers. IT is by the end or design of any power or movement that we must direct its motions, and estimate the degree of force necessary to its just action,

tion. If it wants the force requisite for the obtaining its end, we reckon it defective; if it has too much, so as to be carried beyond it, we say it is overcharged; and in either case it is imperfect and ill-contrived. If it has just enough to reach the scope, we esteem it right and as it should be. Let us apply this reasoning to the passions.

Measure of the defensive passions.

The defence and security of the individual being the aim of the defensive passions, that security and defence must be the measure of their strength or indulgence. If they are so weak as to prove insufficient for that end, or if they carry us beyond it, *i. e.* raise unnecessary commotions, or continue longer than is needful they are unfit to answer their original design, and therefore are in an unsound and unnatural state. The exercise of fear or of resentment has nothing desirable in it, nor can we give way to either without painful sensations. Without a certain degree of them, we are naked and exposed. With too high a proportion of them, we are miserable, and often injurious to others. Thus cowardice or timidity, which is the excess of fear, instead of saving us in danger, gives it too formidable an appearance, makes us incapable of attending to the best means of preservation, and disarms us of courage, our natural armour. Fool-hardiness, which is the want of a due measure of fear, leads us heedlessly into danger, and lulls us into a pernicious security. Revenge, *i. e.* excessive resentment, by the violence of its commotion, robs us of that presence of mind which is often the best guard against injury, and inclines us to pursue the aggressor with more severity than self-defence requires. Pusillanimity, or the want of a just indignation against wrong, leaves us quite ungarded, and tends to sink the mind into a passive enervated tameness. Therefore, " to keep the defensive passions duly proportioned to our dangers, is their natural pitch and tenor."

The

Measure of the private passions.

The private passions lead us to pursue some positive species of private good: that good therefore which is the object and end of each must be the measure of their respective force, and direct their operation. If they are too weak or sluggish to engage us in the pursuit of their several objects, they are evidently deficient; but if they defeat their end by their impetuosity, then they are strained beyond the just tone of nature. Thus vanity, or an excessive passion for applause, betrays into such meannesses and little arts of popularity as makes us forfeit the honour we so anxiously court. On the other hand, a total indifference about the esteem of mankind, removes a strong guard and spur to virtue, and lays the mind open to the most abandoned prosecutions. Therefore, "to keep our private passions and desires proportioned to our wants, is the just measure and pitch of this class of affections."

Comparative force.

The defensive and private passions do all agree in general, in their tendency or conduciveness to the interest or good of the individual. Therefore, when there is a collision of interests, as may sometimes happen, that aggregate of good or happiness, which is composed of the particular goods to which they respectively tend, must be the common standard by which their comparative degrees of strength are to be measured: that is to say, if any of them, in the degree in which they prevail, are incompatible with the greatest aggregate of good or most extensive interest of the individual, then are they unequal and disproportionate. For, in judging of a particular system or constitution of powers, we call that the supreme or principal end, in which the aims of the several parts or powers coincide, and to which they are subordinate; and reckon them in due proportion to each other, and right with regard to the whole, when they maintain that subordination of subserviency. Therefore,

fore, "to proportion our defensive and private passions in such measure to our dangers and wants as best to secure the individual, and obtain the greatest aggregate of private good or happiness, is their just balance or comparative standard in case of competition."

Measure of the public affections.

In like manner as the public or social affections point at the good of others, that good must be the measure of their force. When a particular social affection, as gratitude or friendship, which belongs to a particular social connection, viz. that of a benefactor or of a friend, is too feeble to make us act the grateful or friendly part, that affection, being insufficient to answer its end, is defective and unsound. If on the other hand, a particular passion of this class counteract or defeat the interest it is designed to promote, by its violence or disproportion, then is that passion excessive and irregular. Thus natural affection, if it degenerates into a passionate fondness, not only hinders the parents from judging coolly of the interest of their offspring, but often leads them into a most partial and pernicious indulgence.

Collision of social affections.

As every kind affection points at the good of its particular object, it is possible there may be sometimes a collision of interests or goods. Thus the regard due to a friend may interfere with that which we owe to a community. In such a competition of interests, it is evident that the greatest is to be chosen; and that is the greatest interest which contains the greatest sum or aggregate of public good, greatest in quantity as well as duration. This then is the common standard by which the respective forces and subordinations of the social affections must be adjusted. Therefore we conclude, that "this class of affections are sound and regular when they prompt us to pursue the interest of individuals in an entire consistency with the public good,"

or,

or, in other words, when they are duly proportioned to the dangers and wants of others, and to the various relations in which we stand to individuals or to society."

Thus we have found, by an induction of particulars, the natural pitch or tenor of the different orders of affection, considered apart by themselves. Now as the virtue or perfection of every creature lies in following its nature, or acting suitably to the just proportion and harmony of its several powers; therefore, "the virtue of a creature endowed with such affections as man, must consist in observing or acting agreeably to their natural pitch and tenor." Let this suffice at least for its first rude sketch.

Balance of affection.

But, as there are no independent affections in the fabric of the mind, no passion that stands by itself, without some relation to the rest, we cannot pronounce of any one, considered apart, that it is either too strong or too weak. Its strength and just proportion must be measured not only by its subserviency to its own immediate end, but by the respect it bears to the whole system of affection. Therefore, we say a passion is too strong, not only when it defeats its own end, but when it impairs the force of other passions, which are equally necessary to form a temper of mind suited to a certain œconomy or state; and too weak, not merely on account of its insufficiency to answer its end, but because it cannot sustain its part or office in the balance of the whole system. Thus the love of life may be too strong when it takes from the regard due to one's country, and will not allow one bravely to encounter dangers, or even death on its account. Again, the love of fame may be too weak when it throws down the fences which render virtue more secure, or weakens the incentives which make it more active and public-spirited.

If

If it be asked, "How far may the affections towards private good or happiness be indulged?" One limit was before fixed for the particular indulgence of each, viz. their subordination to the common aggregate of Good to the private system. In these therefore a due regard is always supposed to be had to health, reputation, fortune, the freedom of action, the unimpaired exercise of reason, the calm enjoyment of one's self, which are all private goods. Another limit now results from the balance of affection just named, viz. "The security and happiness of others;" or, to express it more generally, "a private affection may be safely indulged, when, by that indulgence, we do not violate the obligations which result from our higher relations or public connections." A just respect therefore being had to these boundaries which nature has fixed in the breast of every man, what should limit our pursuits of private happiness? Is nature sullen and penurious? Or does the God of nature envy the happiness of his offspring?

Limits of private affection.

Whether there is ever a real collision of interests between the public and private system of affections, or the ends which each class has in view, will be afterwards considered; but where there is no collision, there is little or no danger of carrying either, but especially the public affections, to excess, provided both kinds are kept subordinate to a discreet and cool self-love, and to a calm and universal benevolence, which principles stand as guards at the head of each system.

Collision of interests.

This then is the conduct of the passions, considered as particular and separate forces, carrying us out to their respective ends; and this is their balance or œconomy, considered as compound powers, or powers mutually related, acting in conjunction towards,

Result.

wards a common end, and consequently as forming a system or whole.

Subordination of powers. Now, whatever adjusts and maintains this balance, whatever in the human constitution is formed for directing the passions so as to keep them from defeating their own end or interfering with each other, must be a principle of a superior nature to them, and ought to direct their measures and govern their proportions. But it was found that reason or reflection is such a principle which points out the tendency of our passions, weighs their influence upon private and public happiness, and shews the best means of attaining either. It having been likewise found that there is another directing or controuling principle, which we call conscience or the moral sense; which, by a native kind of authority, judges of affections and actions, pronouncing some just and good, and others unjust and ill; it follows that the passions, which are mere impulses or blind forces, are principles inferior and subordinate to this judging faculty. Therefore, if we would follow the order of nature, *i. e.* observe the mutual respects and the subordination which the different parts of the human constitution bear one to another, the passions ought to be subjected to the direction and authority of the leading or controuling principles.

In what it consists. We conclude therefore, from this induction, that the constitution or just œconomy of human nature consists in a regular subordination of the passions and affections to the authority of conscience and the direction of reason."

Œconomy of nature, or right temper. That subordination is regular, when the proportion formerly mentioned is maintained; that is to say, "When the defensive passions are kept proportioned to our dangers; when the private passions are proportioned

proportioned to our wants; and when the public affections are adapted to our public connections, and proportioned to the wants and dangers of others." This last branch is expressed somewhat differently from the two former, in order to include that most important relation in which we stand, and those indispensable laws of duty which we owe to the great author of our nature, who, being supremely perfect and happy, has no wants to supply, and is obnoxious to no possibility of change.

Human virtue and perfection.

But the natural state, or the sound and vigorous constitution of any creature, or the just œconomy of its powers, we call its health and perfection; and the acting agreeably to these, its virtue or goodness. "Therefore the health and perfection of man must lie in the aforesaid supremacy of conscience and reason, and in the subordination of the passions to their authority and direction. And his virtue or goodness must consist in acting agreeably to that order or œconomy."

How conformable to reason.

That such an ornament of the mind, and such a conduct of its powers and passions, will stand the test of reason, cannot admit of any dispute. For, upon a fair examination into the consequences of things, or the relations and aptitudes of means to ends, reason evidently demonstrates, and experience confirms it, that, "To have our defensive passions duly proportioned to our dangers, is the surest way to avoid or get clear of them, and obtain the security we seek after."—"To proportion our private passions to our wants, is the best means to supply them;—and, to adapt our public affections to our social relations, and the good of others, is the most effectual method of fulfilling one, and procuring the other." In this sense, therefore, virtue may be said to be a "conduct conformable to reason," as reason discovers an apparent aptitude, in such an order and œconomy of

powers

powers and passions, to answer the end for which they are naturally formed.

Connection between affections and ends, not the idea of moral obligation.

If the idea of moral obligation is to be deduced merely from this aptitude or connection between certain passions, or a certain order and balance of passions, and certain ends, obtained or to be obtained by them, then is reason or reflection, which perceives that aptitude or connection, the proper judge of moral obligation; and on this supposition it may be defined, as hath been done by some, the connection between the affection and the end, or, which is the same thing, between the action and the motive; for the end is the motive, or the final cause, and the affection is the action, or its immediate natural cause. A man, from mere self-love, may be induced to fulfil that obligation which is founded on the connection between the defensive passions and their ends, or the private passions and their ends; because in that case his own interest will prompt him to indulge them in the due proportion required. But if he has no affections which point beyond himself, no principle but self-love, or some subtle modification of it, what shall interest him in the happiness of others, where there is no connection between it and his own; or what sense can he have of moral obligation to promote it? Upon this scheme, therefore, without public or social affection, there could be no motive, and consequently no moral obligation, to a beneficent disinterested conduct.

But if the mere connection between certain passions, or a certain order of passions and certain ends, is what constitutes or gives us the idea of moral obligation, then why may not the appositeness of any temper or conduct, nay, of any piece of machinery to obtain its end, form an equally strict moral obligation? For the connection and aptitude are as strong and invariable in the latter instances

as

as in the former. But as this is confounding the most obvious differences of things, we must trace the idea of moral obligation to another and a more natural source.

Idea of it from experience.

Let us appeal, therefore, to our inmost sense and experience, "How we stand affected to those different sets of passions, in the just measure and balance of which we found a right temper to consist." For this is intirely a matter of experience, in which we must examine, as in any other natural inquiry, "What are the genuine feelings and operations of nature, and what affections or symptoms of them appear in the given instance."

Why the defensive passions approved.

The defensive passions, as anger and fear, give us rather pain than pleasure, yet we cannot help feeling them when provoked by injury, or exposed to harm. We account the creature imperfect that wants them, because they are necessary to its defence. Nay, we should in some measure condemn ourselves, did we want the necessary degree of resentment and caution. But if our resentment exceeds the wrong received, or our caution the evil dreaded, we then blame ourselves for having over-acted our part. Therefore, while we are in danger, to be totally destitute of them, we reckon a blameable defect, and to feel them in a just, *i. e.* necessary measure, we approve, as suited to the nature and condition of such a creature as man. But our security obtained, to continue to indulge them, we not only disapprove, as hurtful, but condemn as unmanly, unbecoming, and mean-spirited: nor will such a conduct afford any self-approving joy when we coolly reflect upon it.

Why the private.

With regard to the private passions, such as love of life, pleasure, ease, and the like, as these aim at private good, and are necessary to the perfection and happiness of the individual, we should reckon any creature defective, and even blameable, that was destitute of them. Thus, we condemn the man who imprudently

dently ruins his fortune, impairs his health, or exposes his life; we not only pity him as an unfortunate creature, but feel a kind of moral indignation and contempt of him, for having made himself such. On the other hand, though a discreet self-regard does not attract our esteem and veneration, yet we approve of it in some degree, in an higher and different degree from what we would regard a well-contrived machine, as necessary to constitute a finished creature, nay, to complete the virtuous character, and as exactly suited to our present indigent state. There are some passions respecting private good, towards which we feel higher degrees of approbation, as the love of knowledge, of action, of honour, and the like. We esteem them as marks of an ingenuous mind, and cannot help thinking the character in which they are wanting remarkably stupid, and in some degree immoral.

Why the public.

With regard to the social affections, as compassion, natural affection, friendship, benevolence, and the like, we approve, admire, and love them in ourselves, and in all in whom we discover them, with an esteem and approbation, if not different in kind, yet surely far superior in degree, to what we feel towards the other passions. These we reckon necessary, just, and excellently fitted to our structure and state; and the creature which wants them we call defective, ill-constituted, a kind of abortion. But the public affections we esteem as self-worthy, originally and eternally amiable. We approve and congratulate ourselves in proportion as we indulge them, and reckon those deserving of our esteem and friendship who do so.

Distinction between vehement and calm affections.

But among the social affections we make an obvious and constant distinction, viz. between those particular passions which urge us with a sudden violence, and uneasy kind of sensation, to pursue the good of their respective objects, as pity, natural

natural affection, and the like; and those calm dispassionate affections and desires which prompt us more steadily and uniformly to promote the happiness of others. The former we generally call passions, to distinguish them from the other sort, which go more commonly by the name of affections, or calm desires. The first kind we approve indeed, and delight in; but we feel still higher degrees of approbation and moral complacence towards the last, and towards all limitation of the particular instincts, by the principle of universal benevolence. The more objects the calm affections take in, and the worthier they are, their dignity rises in proportion, and with this our approbation keeps an exact pace. A character, on the other hand, which is quite divested of these public affections, which feels no love for the species, but instead of it entertains malice, rancour, and ill-will, we reckon totally immoral and unnatural.

Such then are the sentiments and dispositions we feel, when these several orders of affection pass before the mental eye.

Therefore, "that state in which we feel ourselves moved, in the manner above described, towards those affections and passions, as they come under the mind's review, and in which we are, instantaneously and independently of our choice or volition, prompted to a correspondent conduct, we call a state of moral obligation." Let us suppose, for instance, a parent, a friend, a benefactor, reduced to a condition of the utmost indigence and distress, and that it is in our power to give them immediate relief. To what conduct are we obliged? What duty does nature dictate and require in such a case? Attend to nature, and nature will tell, will tell with a voice irresistibly audible and commanding to the human heart, with an authority which no man can silence without being self-condemned, and which no man can

Moral obligation.

can elude but at his peril: "that immediate relief ought to be given." Again, let a friend, a neighbour, or even a stranger, have lodged a deposit in our hands, and after some time reclaim it, no sooner do these ideas of the confidenee reposed in us, and of property not transferred, but deposited, occur, than we immediately and unavoidably feel and recognise the obligation to restore it. In both these cases we should eondemn and even loathe ourselves if we aeted otherwise, as having done, or omitted doing, what we ought not, as having acted beneath the dignity of our nature;—eontrary to our most intimate sense of right and wrong;—we should accuse ourselves as guilty of ingratitude, injustice, and inhumanity,—and be conscious of deserving the censure, and therefore dread the resentment, of all rational beings.—But in complying with the obligation, we feel joy and self-approbation,—are eonscious of an inviolable harmony between our nature and duty—and think ourselves intitled to the applause of every impartial speetator of our conduet.'

Moral obligation. To describe therefore, what we cannot perhaps define, a state of moral obligation is "that state in which a ereature, endued with sueh senses, powers, and affections as man would eondemn himself, and think he deserved the eondemnation of all others, should he refuse to fulfil it; but would approve himself, and expeet the approbation of all others, upon complying with it."

Moral agent. And we call him a moral agent who is in such a state, or is subject to moral obligation. Therefore, as man's structure and connections often subject him to sueh a state of moral obligation, we conclude that he is a moral agent. But as man may sometimes act without knowing what he does, as in cases of phrensy or disease, or in many natural funetions; or, knowing what he does, he may act without choice or affection, as in

cases

cases of necessity or compulsion; therefore to denominate an action moral, *i. e.* approveable, or blameable, it must be done knowingly and willingly, or from affection and choice. "A morally good action then is to fulfil a moral obligation knowingly and willingly." And a morally bad action, or an immoral action, is, "to violate a moral obligation knowingly and willingly." The proposed brevity of the inquiry will not admit of entering into the minuter distinctions of actions.

Moral action good and bad.

As not an action, but a series of actions, constitute a character; as not an affection, but a series of affections, constitute a temper; and as we denominate things by the gross, *à fortiori*, or by the qualities which chiefly prevail in them; therefore we call that a "morally good character, in which a series of morally good actions prevail;" and that a "morally good temper, in which a series of morally good affections have the ascendant." A bad character and bad temper are the reverse. But where the above-mentioned order or proportion of passions is maintained, there a series of morally good affections, and actions will prevail. Therefore, "to maintain that order and proportion, is to have a morally good temper and character." But a "morally good temper and character is moral rectitude, integrity, virtue, or the completion of duty."

Moral character and temper good and bad.

If it be asked, after all, "How we come by the idea of moral obligation or duty?" We may answer, that we come by it in the same way as by our other original and primary perceptions. We receive them all from nature, or the great author of nature. For this idea of moral obligation is not a creature of the mind, or dependent on any previous act of volition, but arises on certain occasions, or when certain other ideas are presented to the mind, as necessarily,

How we come by the idea of moral obligation.

instantaneously, and unavoidably, as pain does upon too near an approach to the fire, or pleasure from the fruition of any good. It does not, for instance, depend on our choice, whether we shall feel the obligation to succour a distressed parent, or to restore a deposit intrusted to us when it is recalled. We cannot call this a compound idea made up of one or more simple ideas. We may, indeed, nay we must, have some ideas antecedent to it, *e. g.* that of a parent—in distress—of a child—able to relieve—of the relation of one to the other—of a trust—of right, &c. But none of these ideas constitute the perception of obligation. This is an idea quite distinct from, and something superadded to, the ideas of the correlatives, or the relation subsisting between them. These, indeed, by a law of our nature, are the occasion of suggesting it; but they are as totally different from it as colours are from sounds. By sense of reflection we perceive the correlatives, our memory recalls the favours or deposit we received, the various circumstances of the case are matters of fact or experience; but some delicate inward organ or power, or call it what we please, does, by a certain instantaneous sympathy, antecedent to the cool deductions of reason, and independent of previous instruction, art, or volition, perceive the moral harmony, the living, irresistible charm of moral obligation, which immediately interests the correspondent passions, and prompts us to fulfil its awful dictates.

The use of reason in moral cases.

We need not apprehend any danger from the quickness of its decisions, nor be frightened because it looks like instinct, and has been called so. Would we approve one for deliberating long, or reasoning the matter much at leisure, whether he should relieve a distressed parent, feed a starving neighbour, or restore the trust committed to him? Should we not suspect the reasoner of knavery, or of very weak affections

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to virtue? We employ reason, and worthily employ it, in examining the condition, relations, and other circumstances of the agent or patient, or of those with whom either of them are connected, or, in other words, the state of the case: and in complicated cases, where the circumstances are many, it may require no small attention to find the true state of the case; but when the relations of the agent or patient, and the circumstances of the action are obvious, or come out such after a fair trial, we should scarce approve him who demurs on the obligation to that conduct which the case suggests. Thus, suppose one to deposit with us a sword, which he comes afterwards to reclaim, but in such circumstances, suppose of phrensy or melancholy, as to give us good ground to suspect that he will use it to the hurt of others, or of himself: in such a case it belongs to reason or prudence coolly to weigh every circumstance, the condition of the proprietor, the consequences of restoring the deposit, and the like; nor should we, on that supposition, condemn the hesitating about the restoring it; but let the proprietor return to himself, the obligation to restitution being now apparent, we should justly suspect the demurrer of something criminal or knavish.

Instinct considered.

As to that objection against this original perception of moral obligation, taken from its being an instinct or necessary determination of our nature; are not the perceptions or determinations of reason equally necessary? Does not every intuitive perception or judgment necessarily extort our assent, when the agreement or disagreement of the ideas which are compared is perceived? Instinct indeed has been considered as something relative merely to bodily sense and appetite, a mere brutal sensation or impulse, in which the mind, or our sublimer powers have no part; and therefore it is a term that has been thought obnoxious to great exceptions in morals;

morals; but is a moral power of perception, or a moral determination, the worse for being interwoven with the very frame and constitution of our nature, for being instantaneous, uniform, and steady in its operations or decision? Why should such a divine instinct be thought less rational, less suitable to the dignity of the mind, than those intuitive perceptions which are conversant about abstract truths, and arise necessarily and instantaneously from the obvious relations of things? And if reason with all its sagacity may sometimes err, nay often does, why should any other power of perception be thought infallible, or be condemned as brutal and irrational if it is not?

Pleasure, not the idea of obligation.

From what has been said, it is evident that it is not the pleasure or agreeable sensations which accompany the exercise of the several affections, nor those consequent to the actions, that constitute moral obligation, or excite in us the idea of it. That pleasure is posterior to the idea of obligation, and frequently we are obliged, and acknowledge ourselves under an obligation, to such affections and actions as are attended with pain; as in the trials of virtue, where we are obliged to sacrifice private to public good, or a present pleasure to a future interest. We have pleasure in serving an aged parent, but it is neither the perception nor prospect of that pleasure which gives us the idea of obligation to that conduct.

Therefore, when we use these terms, obligation, duty, ought, and the like, they stand for a simple idea, an original uncompounded feeling or perception of the human mind, as much as any idea whatsoever, and can no more be defined than any other simple idea; and this perception is not a creature of the mind, but a ray emaning directly from the father of lights, a fair genuine stamp of his hand who impressed every vital and original energy

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on the mind, or, if we chuse rather to say, who ordained those laws of perception by which moral forms attract and charm us with an irresistible power.

But because the learned dexterity of human wit has so marvellously puzzled a plain and obvious subject, we shall consider some of those ingenious theories by which moralists have deduced and explained moral obligation.

SECTION III.

Various Hypotheses concerning Moral Obligation.

FROM the induction which has been made, we shall be able to judge with more advantage of the different hypotheses which have been contrived to deduce the origin of moral obligation.

The scheme of Hobbes.

Hobbes, who saw mankind in an unfavourable attitude, involved in all the distraction and misery of a civil war, seems to have taken too narrow and partial a view of our nature, and has therefore drawn it in a very odious and uncomfortable light. Next to the desire of self-preservation, he makes the governing passions in man the love of glory and of power; and from these, by an arbitrary, unnatural, and unsupported hypothesis, contrary to common experience and common language, he attempts to deduce all the other passions which inflame the minds and influence the manners of men. All men, says he, are by nature equal, that is to say, according to his own explanation, the weakest can do as much mischief as the strongest; all desire and have an equal right to the same things, and want to excel each other in power and honour; but as it is impossible for all to possess the same things, or to obtain a pre-eminence in power and honour, hence must arise mutual contests, a natural

passion

passion to invade the property, and level the power and character of each other, and to raise and secure themselves against the attempts of others*. This state of things, in which every man, having a right to every thing, has likewise a right to prevent his neighbour by force or fraud, he tells us, must naturally produce a state of war and mutual carnage. In such a state, he adds, nothing can be called unjust or unlawful; for he who has a right to the end has also a right to the only means of obtaining or securing it, which, according to him, are force or fraud. And this state he calls the state of nature.—But our shrewd philosopher subjoins, that men, being aware that such a state must terminate in their own destruction, agreed to surrender their private unlimited right into the hands of the majority, or such as the majority should appoint, and to subject themselves in future to the common laws, or to common judges or magistrates. In consequence of this surrender, and of this mutual compact or agreement, they are secured against mutual hostilities, and bound or obliged to a peaceable and good behaviour; so that it is no longer lawful or just (the good man means safe and prudent) to invade and encroach on another: for this would be contrary to compact, and a violation of his promise and faith.—Therefore, as there could be no injustice previous to this compact, so the compact, and it alone, must be the origin of justice, the foundation of duty and moral obligation. This is our subtle philosopher's scheme!

But one may ask him, what obligation is a man under to keep his promise, or stand to his compact, if there be no obligation, no moral tie, distinct from that promise and that compact, independent of and previous to both? If there is none, they must prove a mere rope of sand,

* Vide Hob. de Cive, cap. i. ii. and Leviath. c. xvii, &c.

and

and men are left as loose and unsociable as ever, as much barbarians and wolves as before this union. But if there is a distinct and previous obligation to fidelity, honour, and a regard to one's engagements, then right and wrong, justice and injustice, are antecedent to compact.—Perhaps he will tell us that the necessity of the case, or a regard to our own safety, which is included in that of the public, obliges us to adhere to our engagements. We may be compelled or punished for breach of faith by those to whom we transfer our rights. Force or superior strength of the majority to controul or punish the refractory, is no doubt, the true origin of the obligation, if he will speak out; and self-love is its only judge and measure. And if this be all, then what obligation is a man under to gratitude, charity, friendship, and all those duties of humanity which fall not under the cognizance or controul of law? What obligations to private veracity, honesty, and fidelity, when a man may be a knave with safety? The scheme, therefore, which sets us loose from such obligations, and involves us in such absurdities, must be itself both absurd and wicked. That state of nature which it supposes as its foundation is a mere chimera, a vision of his own brain, which, from the condition and nature of the creature, the growth of a family, the rise of a tribe or clan, we have no reason to believe ever subsisted; therefore the superstructure which he has raised on that foundation is fictitious and chimerical. Hobbes took it for granted, that all men were knaves or fools, and wanted to dress up a system of government agreeable to the corrupt taste of the reigning powers, and to the genius of a most dissolute court, a government contrived to make a small part of mankind tyrants, and all the rest slaves. He measured virtue by mere utility; and while he pretends to be the first that discovered this connection, and gave the only true reason for the practice of honesty,

honesty, he seems to have misunderstood or wilfully overlooked its true nature, and its inseparable connection with the perfection and happiness of the individual.

Scheme of conformity to the divine will.

Another set of moralists establish morals upon the will or positive appointment of the deity, and call virtue a conformity to that will or appointment. All obligation, they say, supposes one who obliges, or who has a right to prescribe, and can reward the obedient, and punish the disobedient. This can be none but our creator. His will therefore is our law, which we are bound to obey. And this they tell us is only sufficient to bind or oblige such imperfect and corrupt creatures as we are, who are but feebly moved with a sense of the beauty and excellency of virtue, and strongly swayed by passion or views of interest.

That virtue, or such a conduct of the passions as hath been above described, is agreeable to the will of God, is evident beyond dispute, as that conduct or scheme of duty is pointed out to us by our inward structure, and as that inward structure is the effect of the will or appointment of the deity. Whatever therefore is agreeable or correspondent to our inward structure, must likewise be agreeable or correspond to the will of God. So that all the indications or sanctions of our duty, which are declared or enforced by our structure, are and may be considered as indications or sanctions of the will of our creator. If these indications, through inattention to or abuse of the structure, prove insufficient to declare; or if these sanctions, through the weakness or wickedness of men, prove insufficient to enforce obedience to the divine will, and the deity is pleased to superadd new indications or new sanctions; these additional indications or sanctions cannot, and are not supposed by the assertors of this scheme, to add any new duty or new moral obligation; but only a new and clearer promulgation of our duty, or

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a new and stronger sanction or motive from interest to perform that duty, and to fulfil that obligation to which we were bound before. It makes no difference as to the matter of obligation, after what manner the will of our creator is enforced or declared to us, whether by word or writ, or by certain inward notices and determinations of our own mind, arising according to a necessary law of our nature.——By whichever of these ways we suppose the divine will intimated to us, the first question that naturally occurs to us is, "why we are obliged to obey the divine will?" If it be answered, that he is our superior, and can reward or punish us as we are obedient or refractory; this is resting obligation upon the foot of interest. If we say, that he is our creator and benefactor, and we ought to obey our creator, and be grateful to our benefactor; this refers our obligation to an inward sense or perception that obedience is due to one's creator, gratitude to one's benefactor. Upon what other principle but this can we connect those relations, and that obedience and gratitude, unless we recur to the principle of self-interest just now mentioned? If the scheme of duty and moral obligation be thought to rest on too slight a foundation, when built on moral perception and the affections of our nature, because these are found insufficient to bind or rather to compel men to their duty, we fear the same objection will militate against this scheme, since all the declarations and sanctions of the divine will have not hitherto had their due effect in producing a thorough and universal reformation.

When some speak of the will of God as the rule of duty, they do not certainly mean a blind arbitrary principle of action, but such a principle as is directed by reason, and governed by wisdom, or a regard to certain ends in preference to others. Unless we suppose some principle in the deity analagous to our sense of obligation,

some antecedent affection, or determination of his nature, to prefer some ends before others, we cannot assign any sufficient, or indeed any possible reason, why he should will one thing more than another, or have any election at all. Whatever therefore is the ground of his choice or will, must be the ground of obligation, and not the choice or will itself.—That this is so, appears farther from the common distinction which divines and philosophers make between moral and positive commands and duties. The former they think obligatory, antecedent to will, or at least to any declaration of it; the latter obligatory only in consequence of a positive appointment of the divine will. But what foundation can there be for this distinction, if all duty and obligation be equally the result of mere will?

Scheme of truth, of the natures and reasons of things.

A more refined tribe of philosophers have attempted to lay the foundation of morals much deeper, and on a more large and firm bottom, viz. the natures and reasons, the truth and fitnesses of things. Senses and affections, they tell us, are vague and precarious; and though they were not, yet irrational principles of action, and consequently very improper foundations on which to rest the eternal and immutable obligations of morality. Therefore they talk much of the abstract natures and reasons of things, of eternal differences, unalterable relations, fitnesses and unfitnesses, resulting from those relations; and from these eternal reasons, differences, relations, and their consequent fitnesses, they suppose moral obligation to arise. A conduct agreeable to them, or, in other words, "a conformity to truth, they call virtue, and the reverse, they call vice*."

We perceive the natures of things by different organs

* See Dr. Clarke, Woollaston, and other eminent writers.

or

or senses; and our reason acts upon them when so perceived, and investigates those relations which subsist between them, or traces what is true, what is false, what may be affirmed, and what denied concerning them. Thus by sense or experience we perceive the nature or character of a benefactor, and of a beneficiary (if one may so express it): and upon comparing them together, a third idea is suggested to us, which we call the relation between the benefactor and the beneficiary; we likewise perceive the foundation of that relation, some benefit received. But are any of these ideas that we which understand by the moral duty or obligation, the idea of gratitude due to the benefactor from the beneficiary? This is evidently a distinct perception, obvious to some sense, organ, or power of perception, but not the result of reasoning. Suppose farther, the benefactor in prison for a small debt, and the beneficiary in affluence: reason may suggest to the latter, that a little share of his wealth bestowed on the former will make a considerable change in his state to the better; but will reason, mere reason, without some degree of affection, prompt him to such a well-placed charity? or will the perception of his relation to his benefactor, and of the benefit received, lead him to approve such a conduct, unless we suppose a sense of feeling quite different from that perception of the intervening relation, and of the ground of that relation? We might, therefore, perceive all the possible reasons, relations, and differences of things, and yet be totally indifferent to this or that conduct, unless we were endued with some sense or affection by which we approved and loved one, or disapproved and disliked the other conduct. Reason may perceive a fitness or aptitude to a certain end; but without some sense or affection we cannot propose, or indeed have any idea of an end, and without an end we cannot con-

ceive any inducement to action. Therefore, before we can understand the natures, reasons, and fitnesses of things, which are said to be the foundation of morals, we must know what natures are meant, to what ends they are fitted, and from what principles or affections they are prompted to act; otherwise we cannot judge of the duty required, or of the conduct becoming that being whom we suppose under moral obligation. But let the natures be once given, and the relations which subsist among them be ascertained, we can then determine what conduct will be obligatory to such natures, and adapted to their condition and œconomy. And to the same natures, placed in the same relations, the same conduct will be eternally and invariably proper and obligatory.

To call morality a conformity to truth, gives no idea, no characteristic of it but what seems equally applicable to vice. For whatever propositions are predicable of virtue, as, that it flows from good affection, or is agreeable to the order of our nature— tends to produce happiness, is beheld with approbation and the like; the contrary propositions are equally true, and may be equally predicated of vice. What is truth, but the conformity of proposition to the nature or existence and reality of things? And has not vice its nature, its existence, its adjuncts, and consequences, as much as virtue? And are not propositions conformable to them true propositions? And therefore is not a conduct suited to, or significative of, such true propositions a true conduct, or a conduct conformable to truth? Could we understand a watch-maker, a painter, or a statuary, talking of their respective arts, should they tell us that a watch, a picture, or a statue, were good when they were true, or done according to truth, and that their art lay in adjusting them to truth, would they not speak more intelligibly, and more to the purpose,

purpose, if they should explain to us their end or use, and, in order to that, shew us their parts both together and separately, the bearings and proportions of those parts, and their reference to that end? Is not such a detail likewise necessary to understand human nature, its duty and end? Will the truth, the abstract natures and reasons, the eternal relations, and fitnesses of things, form such a detail? But suppose it could, yet what degrees of virtue or vice does truth admit? Truth is a simple, uniform, invariable thing, incapable of intension or remission. But virtue and vice admit of almost infinite degrees and variations, and therefore cannot consist of, or be founded upon a thing which admits of none. For such as is the foundation, such must the superstructure be.

Objection against the scheme in section II.

But it is said that to deduce moral obligation from the constitution of our nature, and an inward sense, is to render it exceedingly precarious and mutable, because man might have been differently constituted, so as to approve of treachery, malice, cruelty; and then another or a quite contrary train of duties would have been required, or obligatory.

The answer.

That human nature might have been otherwise constituted than it is, is perhaps true; but that it could have been better constituted, considering its present state and circumstances, may be justly questioned, under his government who does every thing in number, weight, and measure, and who has poured wisdom and beauty over all his works. The little sketch that hath been given of our nature shews that it is admirably adapted to our present condition and the various connections we sustain: we could not have subsisted, or at least not have subsisted so well, in such a condition, nor maintained such connections,

nections, without that successive train of powers and passions with which we are endued. Without them, or with a contrary set, we must have been miserable. And he who ordained the condition, and settled the connections, must likewise have ordained that conduct of powers, and that balance of passions, which is exactly proportioned to that condition and to those connections. Such an order of creatures being supposed, and such a condition with such connections being given, such a conduct as has been traced out must be eternally and invariably obligatory to such creatures so placed and so connected. Had man been a different creature, and placed in different circumstances, a spider, for instance, or an hound, a different set of duties would have then become him; the web, the vigilance, the rapacious conduct of the former; the sagacity, the love of game, and swiftness of the latter, and the satisfaction of appetite, the propagation and love of offspring common to both, would have fulfilled the destinations of his nature, and been his proper business and œconomy. But as man is not only a sensible, an active and a social, but a rational, a political, and religious creature, he has a nobler part to act, and more numerous and more important obligations to fulfil. And if afterwards, in any future period of his duration, he shall be advanced to a superior station, and take in wider connections, the sphere of his duty and the number and weight of his obligations must increase in proportion. Had a creature therefore, situated and connected as man, been formed with dispositions to approve of treachery, malice, or cruelty, such a temper or constitution would have been evidently destructive of his happiness. Now if we imagine the deity prefers some ends to others, suppose the happiness of his creatures to their misery, he must likewise prefer the means most adapted to those ends. Therefore, sup-

posing

posing the deity necessarily wise and good, he could not have implanted in us such dispositions, or, in other words, could not have annexed feelings of approbation to a conduct so incongruous to our state, and so subversive of our happiness. Consequently, amidst the infinite variety of possible constitutions, vice could never have been approveable, and of course not obligatory.—Therefore, "the scheme of human nature above proposed rests on the same foundation as the divine wisdom and goodness, and the scheme of moral obligation erected upon it must be equally immutable and immortal." And that the deity is wise and good, supremely and universally so, nature cries aloud through all her works.

Another objection.

But it is farther objected against this scheme, that mankind differ strangely in their moral sentiments, some approving treachery, revenge, and cruelty, nay whole nations approving theft, the exposition of infants, and many other crimes of as black a dye: therefore the moral sense, recommended as the judge of morals, is either not universal, or a very uncertain and fallacious rule.

The answer.

As to that diversity of opinion, or rather of practice, concerning moral obligation, we can no more conclude from thence that the internal perception, or moral sense of right and wrong, is not an universal or certain standard or rule of judging in morals, than we can infer from the different tastes in painting, or different opinions concerning the merit of the same performances, that there is no standard in painting, no certain and uncontroverted principle of the art. In the last, men appeal from particular tastes, manners, and customs, to nature, as the supreme standard, and acknowledge that the perfection of the art lies in the just imitation of it; but from a diversity in organs, in capacity, in education, from favour, prejudice, and a thousand

sand other circumstances, they differ in applying the rule to particular instances. The same thing holds in morals; men admit the rule in general, and appeal to our common nature and to common sense, nay seldom differ or judge wrong in impartial cases. When at any time they misapply or deviate from the received standard, a fair and satisfying account may be given of their variations.

We have heard of states which allowed theft, and the exposition of lame or deformed children. But in those states there was hardly any property, all things were common; and to train up a hardy, shifting, sagacious youth, was thought far preferable to the security of any private property. The exposition of their children was esteemed the sacrifice of private social affection to the love of the public. We need not doubt but they loved their children; but as such children were accounted useless, and even hurtful to a commonwealth formed entirely upon a warlike plan, they reckoned it gallant to prefer the public to the strongest and most endearing private interest: So that their mistake lay in supposing a real competition between those interests, not in disavowing or divesting themselves of parental affection; a mistake into which they would not have fallen, had they enjoyed a more natural, refined, and extensive system of policy. In some countries they put their aged decrepid parents to death; but is it because they condemn or want natural affection? No, but they think it the best proof of their affection to deliver them from the miseries of old age, which they do not believe can be counterbalanced by all its enjoyments; in short, neither cruelty nor ingratitude, nor any action under an immoral form, are ever approved. Men reason wrong only about the tendency, the consequences, materials, and other circumstances of the action. It may appear in different lights, or with different sides, according to the different views and opinions of the consequences

sequences which the moral spectator or actor has, or according to his passions, habits, and other circumstances; but still the general rule is recognized, the moral quality or species is admired, and the deviation from the rule condemned and disliked. Thus inhumanity is condemned by all; yet persecution for the sake of religious opinions is approved, and even practised, by some, under the notion of compassion to the souls of the sufferers, or to those of others, who, they think, can only be thus secured against the infection of heresy: or under the form of zeal for the honour of God, a divine principle, to which they are persuaded whatever is human ought to stoop: though to every large and well-informed mind such a conduct must appear most barbarous and inhuman, with how pious a name soever it may be sanctified.—No man approves malice, but to hate a wicked character, or to resent an injury, are deemed equally conducive to private security and to public good, and appear to the actors, even in their most outrageous sallies, a noble contempt of vice, or a generous indignation against wrong. The highwayman condemns injustice, and resents the pilfering knavery of a brother of the trade; but to excuse himself he says, necessity has no law, an honest fellow must not starve, he has tried the way of industry, but in vain: the prime law of self-preservation must be obeyed. From these and the like topics, it appears no hard matter to account for the diversity of opinions concerning moral obligation, viz. from mistakes about the tendency of actions, the nature of happiness, or of public and private good; from the partial connections men have formed; from false opinions of religion and the will of God; and from violent passions, which make them misapply the rule, or not attend to the moral quality as they ought. Therefore, by separating what is foreign, and appealing to the true standard of nature, as ascertained above, and

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by observing the reasons of those variations which we find sometimes among individuals, we plainly recognize the stability of the rule of moral obligation, and discern the universality of the sense; and the variations, instead of being exceptions against either, rather concur in confirming one, and demonstrating the other.

Conclusion. From the whole, we may conclude, that the nature, the reasons, and the relations of things would never have suggested to us this simple idea of moral obligation, without a proper sense susceptible of it. It is interwoven with the very frame and constitution of our nature, and by it we are in the strictest sense a law to ourselves. Nor is it left to us to trace out this law by the cool or slow deductions of reason; far less is this law the result of subtle and metaphysical inquiries into the abstract nature and relations of things; we need not ascend to heaven to bring it down from thence, nor descend into the depths to seek it there; it is within us, ever present with us, ever active and incumbent on the mind, and engraven on the heart in the fair and large signatures of conscience, natural affection, compassion, gratitude, and universal benevolence.

SECTION IV.

The final Causes of our Moral Faculties of Perception and Affection.

The survey proposed. WE have now taken a general prospect of man and of his moral powers and connections, and on these erected a scheme of duty, or moral obligation, which seems to be confirmed by experience, consonant to reason, and approved by his most inward and most sacred senses. It may be proper in the next place to

to take a more particular view of the final causes of those delicate springs by which he is impelled to action, and of those clogs by which he is restrained from it.—By this detail we shall be able to judge of their aptitude to answer their end in a creature indued with his capacities, subject to his wants, exposed to his dangers, and susceptible of his enjoyments; and from thence we shall be in a condition to pronounce concerning the end of his whole structure, its harmony with his state, and consequently, its subserviency to answer the great and benevolent intentions of its author.

Inward anatomy of the system of the mind.

In the anatomy of this inward and more elaborate subject, it will not be necessary to pursue every little fibre, nor to mark the nicer complications and various branchings of the more minute parts. It shall suffice to lay open the larger vessels and stronger muscling of this divine piece of workmanship, and to trace their office and use in the disposition of the whole.

The Supreme Being has seen fit to blend in the whole of things a prodigious variety of discordant and contrary principles, light and darkness, pleasure and pain, good and evil. There are multifarious natures, higher and lower, and many intermediate ones between the wide-distant extremes. These are differently situated, variously adjusted, and subjected to each other, and all of them subordinate to the order and perfection of the whole. We may suppose man placed as in a center amidst those innumerable orders of beings, by his outward frame drawing to the material system, and by his inward connected with the intellectual or moral, and of course affected by the laws which govern both, or affected by that good and that ill which result from those laws. In this infinite variety of relations with which he is surrounded, and of contingencies to which he is liable, he feels strong at-

tractions to the good, and violent repulsions or aversions to the ill. But as good and ill are often blended, and wonderfully complicated one with the other; as they sometimes immediately produce and run up into each other, and at other times lie at great distances, yet by means of intervening links introduce one another; and as these effects are often brought about in consequence of hidden relations and general laws, of the energy of which he is an incompetent judge, it is easy for him to mistake good for evil, and evil for good, and consequently he may be frequently attracted by such things as are destructive, or repel such as are salutary. Thus, by the tender and complicated frame of his body, he is subjected to a great variety of ills, to sickness, cold, heat, fatigue, and innumerable wants. Yet his knowledge is so narrow withal, and his reason so weak, that in many cases he cannot judge, in the way of investigation or reasoning, of the connection of those effects with their respective causes, or of the various latent energies of natural things. He is therefore informed of this connection by the experience of certain senses or organs of perception, which, by a mechanical instantaneous motion, feel the good and the ill, receiving pleasure from one, and pain from the other. By these, without any reasoning, he is taught to attract or chuse what tends to his welfare, and to repel and avoid what tends to his ruin. Thus, by his senses of taste and smell, or by the pleasure he receives from certain kinds of food, he is admonished which agree with his constitution, and by an opposite sense of pain he is informed which sorts disagree, or are destructive of it; but is not by means of this instructed in the inward natures and constitutions of things.

Use of appetites and passions.

Some of these senses are armed with strong degrees of uneasiness or pain, in order to urge him to seek after such objects as are suited to them.

And

And these respect his more immediate and pressing wants: as the sense of hunger, thirst, cold, and the like; which by their painful importunities, compel him to provide food, drink, raiment, shelter. Those instincts by which we are thus prompted with some kind of commotion or violence to attract and pursue good, or to repel and avoid ill, we call appetites and passions. By our senses then we are informed of what is good or ill to the private system, or the individual; and by our private appetites and passions we are impelled to one, and restrained from the other.

Man's outward state.

In consequence of this machinery, and the great train of wants to which our nature subjects us, we are engaged in a continued series of occupations, which often require much application of thought, or great bodily labour, or both. The necessaries of life, food, clothes, shelter, and the like, must be provided; conveniences must be acquired to render life still more easy and comfortable. In order to obtain these, arts, industry, manufactures, and trade are necessary. And to secure to us the peaceable enjoyment of their fruits, civil government, policy, and laws must be contrived, and the various business of public life carried on: thus while man is concerned and busied in making provision, or obtaining security for himself, he is by degrees engaged in connections with a family, friends, neighbours, a community, or a commonwealth. Hence arise new wants, new interests, new cares, and new employments. The passions of one man interfere with those of another. Interests are opposed. Competitions arise, contrary courses are taken, disappointments happen, distinctions are made, and parties formed. This opens a vast scene of distraction and embarrassment, and introduces a mighty train of good and ill, both public and private. Yet amidst all this confusion and hurry, plans of action must

must be laid, consequenees foreseen or guarded against, inconveniences provided for; and frequently particular resolutions must be taken, and schemes exeeuted, without reasoning or delay.

Provisions for it.

Now what provision has the Author of our nature made for this necessitous condition? How has he fitted the actor, man, for playing his part in this perplexed and busy scene? He has admonished the individual of private good and private ill by peeuliar senses, and urged him by keen instincts to pursue the former and repel the latter. But what provision, what security, has the deity made for the eommunity, the public? Who or what shall answer for his good behaviour to it?

By public senses and passions.

Our Supreme Parent, watehful for the whole, has not left himself without a witness here neither, and hath made nothing imperfeet, but all things are double one against another. He has not left man to be informed, only by the cool notices of reason, of the good or ill, the happiness or misery of his fellow-creatures. He has made him sensible of their good and happiness, but espeeially of their ill and misery, by an immediate sympathy, or quiek feeling of pleasure and of pain.

Pity.

The latter we call pity or eompassion. For the former, though every one, who is not quite divested of humanity, feels it in some degree, we have not got a name, unless we eall it congratulation, or joyful sympathy, or that good humour whieh arises on seeing others pleased or happy. Both these feelings have been ealled in general the public or common sense, Κοινὴ μνημοσύνη, by whieh we feel for others, and are interested in their coneerns as really, though perhaps less sensibly than in our own.

Congratulation.

Resentment.

When we see our fellow-creatures unhappy through

through the fault or injury of others, we feel resentment or indignation against the unjust causers of that misery. If we are conscious that it has happened through our fault or injurious conduct, we feel shame; and both these classes of senses and passions, regarding misery and wrong, are armed with such sharp sensations of pain as not only prove a powerful guard and security to the species, or public system, against those ills it may, but serve also to lessen or remove those ills it does, suffer. Compassion draws us out of ourselves to bear a part of the misfortunes of others, powerfully solicits us in their favour, melts us at sight of their distress, and makes us in some degree unhappy till they are relieved from it. It is peculiarly well adapted to the condition of human life, because, as an eminent moralist * observes, it is much more and oftener in our power to do mischief than good, and to prevent or lessen misery than to communicate positive happiness; and therefore it is an admirable restraint upon the more selfish passions, or those violent impulses that carry us to the hurt of others.

Public affections.

There are other particular instincts or passions which interest us in the concerns of others, even while we are most busy about our own, and which are strongly attractive of good, and repulsive of ill to them. Such are natural affection, friendship, love, gratitude, desire of fame, love of society, of one's country, and others that might be named. Now as the private appetites and passions were found to be armed with strong sensations of desire and uneasiness, to prompt man the more effectually to sustain labours, and to encounter dangers in pursuit of those goods that are necessary to the preservation and welfare of the individual, and to avoid those ills which tend to his destruction; in like

* Vide Butler's sermon on compassion.

manner

manner it was necessary, that this other class of desires and affections should be prompted with as quick sensations of pain, not only to counteract the strength of their antagonists, but to engage us in a virtuous activity for our relations, families, friends, neighbours, country. Indeed our sense of right and wrong will admonish us that it is our duty, and reason and experience farther assure us that it is both our interest and best scuurity, to promote the happiness of others; but that sense, that reason, and that experience, would frequently prove but weak and ineffectual prompters to such a conduct, especially in cases of danger and hardship, and amidst all the importunities of nature, and that constant hurry in which the private passions involve us, without the aid of those particular kind affections which mark out to us particular spheres of duty, and with an agreeable violence engage and fix us down to them.

Contrast or balance of passions.

It is evident, therefore, that those two classes of affection, the private and public, are set one against the other, and designed to controul and limit each other's influence, and thereby to produce a just balance in the whole*. In general, the violent sensations of pain and uneasiness which accompany hunger, thirst, and the other private appetites, or too great fatigue of mind as well as of body, prevent the individual from running to great excesses in the exercise of the higher functions of the mind, as too intense thought in the search of truth, violent application to business of any kind, and different degrees of romantic heroism. On the other hand, the finer senses of perception, and those generous desires and affections which are connected with them, the love of action, of imitation, of truth, honour, public virtue, and the like, are wisely placed in the op-

* Vide Hutch. Conduct of the Passions, treat. 1. § 2.

posite

posite scale, in order to prevent us from sinking into the dregs of the animal life, and debasing the dignity of man below the condition of brutes. So that, by the mutual re-action of those opposite powers, the bad effects are prevented that would naturally result from their acting singly and apart, and the good effects are produced which each are severally formed to produce.

Contrast or balance of public and private passions.

The same wholesome opposition appears likewise in the particular counter-workings of the private and public affections one against the other. Thus compassion is adapted to counterpoise the love of ease, of pleasure, and of life, and to disarm or to set bounds to resentment; and resentment of injury done to ourselves, or to our friends who are dearer than ourselves, prevents an effeminate compassion or consternation, and gives us a noble contempt of labour, pain, and death. Natural affection, friendship, love of one's country, nay, zeal for any particular virtue, are frequently more than a match for the whole train of selfish passions. On the other hand, without that intimate over-ruling passion of self-love, and those private desires which are conneeted with it, the social and tender instincts of the human heart would degenerate into the wildest dotage, the most torturing anxiety, and downright phrensy.

Contrasts among those of the same classes.

But not only are the different orders or classes of affection checks one upon another, but passions of the same classes are mutual clogs. Thus, how many are withheld from the violent outrages of resentment by fear? And how easily is fear controuled in its turn, while mighty wrongs awaken a mighty resentment! The private passions often interfere, and therefore moderate the violence of each other; and a calm self-love is placed at their head, to direct, influence, and controul their particular attractions and repulsions.

pulsions. The public affections likewise restrain one the other; and all of them are put under the controul of a calm dispassionate benevolence, which ought in like manner to direct and limit their particular motions.—Thus most part if not all the passions have a twofold aspect, and serve a twofold end. In one view they may be considered as powers, impelling mankind to a certain course, with a force proportioned to the apprehended moment of the good they aim at. In another view they appear as weights, balancing the action of the powers, and controuling the violence of their impulses. By means of these powers and weights a natural poise is settled in the human breast by its all-wise author, by which the creature is kept tolerably steady and regular in his course, amidst that variety of stages through which it must pass.

Particular perceptions or instincts of approbation.

But this is not all the provision which God has made, for the hurry and perplexity of the scene in which man is destined to act. Amidst those infinite attractions and repulsions towards private and public good and ill, mankind either cannot often foresee the consequences or tendencies of all their actions towards one or other of these, especially where those tendencies are intricate and point different ways, or those consequences remote and complicated; or though, by careful and cool inquiry, and a due improvement of their rational powers, they might find them out, yet, distracted as they are with business, amused with trifles, dissipated by pleasure, and disturbed by passion, they either have or can find no leisure to attend to those consequences, or to examine how far this or that conduct is productive of private or public good on the whole. Therefore, were it left entirely to the slow and sober deductions of reason to trace those tendencies and make out those consequences, it is evident, that in many particular

ticular instances, the business of life must stand still, and many important occasions of action be lost, or perhaps the grossest blunders be committed. On this account the deity, besides that general approbation which we bestow on every degree of kind affection, has moreover implanted in man many particular perceptions or determinations to approve of certain qualities or actions, which, in effect, tend to the advantage of society, and are connected with private good, though he does not always see that tendency, nor mind that connection. And these perceptions or determinations do without reasoning point out, and, antecedent to views of interest, prompt to a conduct beneficial to the public, and useful to the private system. Such is that sense of candour and veracity, that abhorrence of fraud and falsehood, that sense of fidelity; justice, gratitude, greatness of mind, fortitude, clemency, decorum; and that disapprobation of knavery, injustice, ingratitude, meanness of spirit, cowardice, cruelty, and indecorum, which are natural to the human mind. The former of those dispositions, and the actions flowing from them, are approved, and those of the latter kind disapproved by us, even abstracted from the view of their tendency or conduciveness to the happiness or misery of others or of ourselves. In one we discern a beauty, a superior excellency, a congruity to the dignity of man; in the other a deformity, a littleness, a debasement of human nature.

Others of an inferior order.

There are other principles also connected with the good of society, or the happiness and perfection of the individual, though that connection is not immediately apparent, which we behold with real complacency and approbation, though perhaps inferior in degree, if not in kind, such as gravity, modesty, simplicity of deportment, temperance, prudent œconomy; and we feel some degree of contempt and dislike where

 they

they are wanting, or where the opposite qualities prevail. These and the like perceptions or feelings are either different modifications of the moral sense, or subordinate to it, and plainly serve the same important purpose, being expeditious monitors in the several emergencies of a various and distracted life, of what is right, what is wrong, what is to be pursued, and what avoided; and, by the pleasant or painful consciousness which attends them, exerting their influence as powerful prompters to a suitable conduct.

Their general tendencies.

From a slight inspection of the above-named principles, it is evident they all carry a friendly aspect to society and the individual, and have a more immediate or a remote tendency to promote the perfection or good of both. This tendency cannot be always foreseen, and would be often mistaken or seldom attended to by a weak, busy, short-sighted creature like man, both rash and variable in his opinions, a dupe to his own passions or to the designs of others, liable to sickness, to want, and to error. Principles, therefore, which are so nearly linked with private security and public good, by directing him, without operose reasoning, where to find one and how to promote the other, and, by prompting him to a conduct conducive to both, are admirably adapted to the exigencies of his present state, and wisely calculated to obtain the ends of universal benevolence.

Passions fitted to a state of trial.

It were easy, by considering the subject in another light, to shew, in a curious detail of particulars, how wonderfully the inside of man, or that astonishing train of moral powers and affections with which he is endued, is fitted to the several stages of that progressive and probationary state through which he is destined to pass. As our faculties are narrow and limited, and rise from very small and imperfect beginnings, they

must

must be improved by exercise, by attention, and repeated trials. And this holds true not only of our intellectual, but our moral and active powers. The former are liable to errors in speculation, the latter to blunders in practice, and both often terminate in misfortunes and pains. And those errors and blunders are generally owing to our passions, or to our too forward and warm admiration of those partial goods they naturally pursue, or to our fear of those partial ills they naturally repel. Those misfortunes therefore lead us back to consider where our misconduct lay, and whence our errors flowed; and consequently are salutary pieces of trial, which tend to enlarge our views, to correct and refine our passions, and consequently improve both our intellectual and moral powers.—Our passions then are the rude materials of our virtue, which heaven has given us to work up, to refine and polish into an harmonious and divine piece of workmanship. They furnish out the whole machinery, the calms and storms, the lights and shades of human life. They shew mankind in every attitude and variety of character, and give virtue both its struggles and its triumphs. To conduct them well in every state, is merit; to abuse or misapply them, is demerit. By them we prove what we are; and by the habits to which they give birth, we take our form and character for the successive stages of our life, or any future period of our existence.

To a progressive state.

The different sets of senses, powers, and passions, which unfold themselves in those successive stages, are both necessary and adapted to that rising and progressive state. Enlarging views and growing connections require new passions and new habits; and thus the mind, by these continually expanding and finding a progressive exercise, rises to higher improvements, and pushes forward to maturity and perfection.—But on this we cannot farther insist.

In

Harmony of our structure and state.

In this beautiful œconomy and harmony of our structure, both outward and inward, with that state, we may at once discern the great lines of our duty traced out in the fairest and brightest characters, and contemplate with admiration a more august and marvellous scene of divine wisdom and goodness laid in the human breast, than we shall perhaps find in the whole compass of nature. "What a piece of work is man! how noble in reason! how infinite in faculties! In form and moving, how express and admirable! in action, how like an angel! in apprehension, how like a God! the beauty of the world! the paragon of animals!"

Result.

In what œconomy virtue consists.

From this detail it appears, that man, by his original frame, is made for a temperate, compassionate, benevolent, active, and progressive state. He is strongly attractive of the good, and repulsive of the ills, which befal others as well as himself. He feels the highest approbation and moral complacence in those affections, and in those actions, which immediately and directly respect the good of others, and the highest disapprobation and abhorrence of the contrary. Besides these, he has many particular perceptions or instincts of approbation, which, though perhaps not of the same kind with the others, yet are accompanied with correspondent degrees of affection, proportioned to their respective tendencies to the public good. Therefore, by acting agreeably to these principles, man acts agreeably to his structure, and fulfils the benevolent intentions of its author. But we call a thing good when it answers its end, and a creature good when he acts in a conformity to his constitution. Consequently, man must be denominated good or virtuous when he acts suitably to the principles and destination of his nature. And where his virtue lies, there also is his rectitude, his dignity, and perfection to be found.

found. And this coincides with the account of virtue formerly given, but presents it in another attitude, or sets it in a light something different.

BOOK II. SECTION I.

The principal distinctions of Duty or Virtue.

WE have now considered the constitution and connections of man, and on those erected a general system of duty, or moral obligation, consonant to reason, approved by his most sacred and intimate sense, suitable to his mixed condition, and confirmed by the experience of mankind. We have also traced the final causes of his moral faculties and affections to those noble purposes they answer, with regard both to the private and the public system.

General Division of duty.

From this induction it is evident, that there is one order or class of duties which man owes to himself: another to society: and a third to God.

Duty to one's self.

The duties he owes to himself are founded chiefly on the defensive and private passions, which prompt him to pursue whatever tends to private good or happiness, and to avoid or ward off whatever tends to private ill or misery. Among the various goods which allure and solicit him, and the various ills which attack or threaten him, "to be intelligent and accurate in selecting one, and rejecting the other, or in preferring the most excellent goods, and avoiding the most terrible ills, when there is a competition among either, and to be discreet in using the best means to attain the goods and avoid the ills, is what we call prudence." This, in our inward frame, corresponds to sagacity, or quickness of

sense

sense in our outward. "To proportion our defensive passions to our dangers, we call fortitude;" which always implies a just mixture of calm resentment or animosity, and well-governed caution." And this firmness of mind answers to the strength and muscling of the body.—And "duly to adjust our private passions to our wants, or to the respective moment of the good we affect or pursue, we call temperance;" which does therefore always imply, in this large sense of the word, "a just balance or command of the passions," and answers to the health and sound temperament of the body*.

Duties to society.

The second class of duties arises from the public or social affections, "the just harmony or proportion of which to the dangers and wants of others, and to the several relations we bear, commonly goes by the name of justice." This includes the whole of our duty to society, to its parent, and the general polity of nature; particularly gratitude, friendship, sincerity, natural affection, benevolence, and the other social virtues: this, being the noblest temper and fairest complexion of the soul, corresponds to the beauty and fine proportion of the person. The virtues comprehended under the former class, especially prudence and fortitude, may likewise be transferred to this; and according to the various circumstances in which they are placed, and the more confined or more extensive sphere in which they operate, may be denominated private, œconomical, or civil prudence, fortitude, &c. These direct our conduct with regard to the wants and dangers of those lesser or greater circles with which they are connected.

Duties to God.

The third class of duties respects the deity, and arises from the public affections, and the several glorious relations which he sustains to us, as our creator, benefactor, lawgiver, judge, &c.

* Vid. Tim. Locr. de Anima Mundi.

We

We chose to consider this set of duties in the last place, because though prior in dignity and excellency, they seem to be last in order of time, as thinking it the most simple and easy method to follow the gradual progress of nature as it takes its rise from individuals, and spreads through the social system, and still ascends upwards, till at length it stretches to its almighty Parent and head, and so terminates in those duties which are highest and best.

Method.

The duties resulting from these relations are reverence, gratitude, love, resignation, dependence, obedience, worship, praise; which, according to the model of our finite capacities, must maintain some sort of proportion to the grandeur and perfection of the object whom we venerate, love, and obey. "This proportion or harmony is expressed by the general name of piety or devotion," which is always stronger or weaker, according to the greater or less apprehended excellency of its object. This sublime principle of virtue is the enlivening soul which animates the moral system, and that cement which binds and sustains the other duties which man owes to himself or to society. From hence, as will appear afterwards, they derive not only the firmest support, but their highest relief and lustre.

Piety.

This then is the general temper and constitution of virtue, and these are the principle lines and divisions of duty. To those good dispositions which respect the several objects of our duty, and to all actions which flow from such dispositions, the mind gives its sanction or testimony. And this sanction or judgment concerning the moral quality, or the goodness of actions or dispositions, moralists call conscience. When it judges of an action that is to be performed, it is called an antecedent conscience, and when it passes sentence on

Division of conscience.

Goodness of an action. on an action which is performed, it is called a subsequent conscience. The tendency of an action to produce happiness, or its external conformity Material. to a law is termed its material goodness. But the good dispositions from which an action proceeds, or its conformity to law in every respect con- Formal. stitutes its formal goodness.

Natural and Moral. Some moralists, of no mean figure, reckon it necessary to constitute the formal goodness of an action, "that we reflect on the action with moral complacency and approbation, for mere affection, or a good temper, whether it respects others or ourselves, they call natural or instinctive goodness, of which the brutes are equally capable with man But when that affection or temper is viewed with approbation, and made the object of a new affection, this, they say, constitutes moral goodness or virtue, in the strict sense of the word, and is the characteristic of moral or rational agents."

Whether approbation is necessary to complete the idea of virtue. It must be acknowleged, that men may be partially good, *i.e.* may indulge some kind affections, and do some kind actions, and yet may be vicious or immoral on the whole. Thus a man may be affectionate to his child, and injurious to his neighbour; or compassionate to his neighbour, and cruel to his country; or zealous for his country, and yet inhuman to mankind. It must also be acknowledged, that to make every degree and act of good affection the frequent object of our attention,—to reflect on these with moral approbation and delight,—to be convinced, on a full and impartial review, that virtue is most amiable in itself, and attended with the most happy consequences, is sometimes a great support to virtue, in many instances necessary to complete the virtuous character, and always of use to give uniformity and stability to virtuous prin- ciples,

ciples, especially amidst the numberless trials to which they are exposed in this mixed scene of human life. Yet how many of our fellow-creatures do we esteem and love, who perhaps never coolly reflected on the beauty or fair proportions of virtue, or turned it into a subject of their moral approbation and complacency! Philosophers, or contemplative men, may very laudably amuse themselves with such charming theories, and often do contemplate every the minutest trace of virtue about themselves with a parental fondness and admiration, and by those amiable images reflected from themselves, they may perhaps be confirmed in the esteem of whatever is honest and praise worthy. However, it is not generally among this recluse set of men that we expect to find the highest flights of virtue; but rather among men of action and business, who, through the prevalence of a natural good temper, or from generous affections to their friends, their country, or mankind, are truly and transcendently good. Whatever that quality is which we approve in any action, and count worthy our esteem, and which excites an esteem and love of the agent, we call the virtue, merit, or formal goodness of that action. And if actions invested with such a quality have the ascendant in a character, we call that character virtuous or good: now it is certain that those qualities or principles mentioned above, especially those of the public and benevolent kind, how simple, how instinctive soever, are viewed with approbation and love. The very nature of that principle we call conscience, which approves these benevolent affections; and whatever is done through their influence intimates that virtue or merit is present in the mind before conscience is exercised, and that its office is only to observe it there, or to applaud it. For if virtue is something that deserves our esteem and love, then it must exist before conscience is exerted, or gives its testimony. Therefore to say that

the testimony of conscience is necessary to the being or form of a virtuous action, is, in plain terms, to affirm that virtue is not virtue till it is reflected on and approved as virtue. The proper business of reason, in forming the virtuous character, is to guide the several affections of the mind to their several objects, and to direct us to that conduct, or to those measures of action, which are the most proper means of acquiring them. Thus, with respect to benevolence, which is the virtue of a character, or a principal ingredient of merit, its proper object is the public good. The business of reason then is to inform us wherein consists the greatest public good, what conduct and which actions are the most effectual means of promoting it. After all, the motions of the mind are so quick and imperceptible, and so complicated with each other, that perhaps seldom do any indulge the virtuous or good affections without an approving consciousness; and certainly the more that virtue is contemplated with admiration and love, the more firm and inflexible will the spectator be in his attachment to it.

Divisions of conscience.

When the mind is ignorant or uncertain about the moment of an action, or its tendency to private or public good, or when there are several circumstances in the case, some of which, being doubtful, render the mind dubious concerning the morality of the action, this is called a doubtful or scrupulous conscience; if it mistakes concerning these, it is called an erroneous conscience. If the error or ignorance is involuntary or invincible, the action proceeding from that error, or from that ignorance, is reckoned innocent, or not imputable. If the error or ignorance is supine or affected, *i. e.* the effect of negligence, or of affectation and wilful inadvertence, the conduct flowing from such error, or such ignorance, is criminal and imputable. Not to follow one's conscience, though erroneous and ill-informed,

formed, is criminal, as it is the guide of life; and to counteract it, shews a depraved and incorrigible spirit. Yet to follow an erroneous conscience is likewise criminal, if that error which misled the conscience was the effect of inattention, or of any criminal passion*.

How conscience is to be rectified.

If it be asked, "how an erroneous conscience shall be rectified, since it is supposed to be the only guide of life, and judge of morals?" We answer in the very same way that we would rectify reason if at any time it should judge wrong, as it often does, viz. by giving it proper and sufficient materials for judging right, *i. e.* by inquiring into the whole state of the case, the relations, connections, and several obligations of the actor, the consequences and other circumstances of the action, or the surplusage of private or public good which results, or is likely to result, from the action or from the omission of it. If those circumstances are fairly and fully stated, the conscience will be just and impartial in its decision: for, by a necessary law of our nature, it approves and is well affected to the moral form; and if it seems to approve of vice or immorality, it is always under the notion or mask of some virtue. So that, strictly speaking, it is not conscience which errs; for its sentence is always conformable to the view of the case which lies before it: and is just, upon the supposition that the case is truly such as it is represented to it. All the fault is to be imputed to the agent, who neglects to be better informed, or who, through weakness or wickedness, hastens to pass sentence from an imperfect evidence. Thus he who persecutes another for the sake of conscience, or a mistake in religious opinion, does not approve of injustice or cruelty any more than his mistaken neighbour who suffers by it; but, thinking the severity he uses conformable to

* Vid. Hutches. Moral Inst. Lib. II. Chap. 3.

the

the divine will, or salutary to the patient, or at least to the society of the faithful, whose interests he reckons far preferable not only to the interest of so small a part, but to all the vast remainder of mankind; and thinking withal that severity is the only means of securing that highest interest, he passes a sentence as just, and consequential from those principles, as a physician, who to save the whole body, orders the amputation of a gangrened limb, thinking that the only remedy. Perhaps, in the latter case, an abler practitioner might have accomplished the cure by a less dangerous operation: and in the former, a better casuist, or a greater master in spiritual medicine, might have contrived a cure full as sure and much more innocent.

Having now given the general divisions of duty or virtue, which exhibit its different faces and attitudes as it stands directed to its respective objects; let us next descend into particulars, and mark its more minute features and proportions as they appear in the detail of human life.

SECTION II.

Of Man's Duty to himself. Of the nature of Good, and the chief Good.

Divisions of Good.

EVERY creature, by the constitution of his nature, is determined to love himself; to pursue whatever tends to his preservation and happiness, and to avoid whatever tends to his hurt and misery. Being endued with sense and perception, he must necessarily receive pleasure from some objects, and pain from others. Those objects which give pleasure, are called good; and those which give pain, evil. To the former he feels that attraction

attraction or motion we call desire, or love: to the latter, that impulse we call aversion, or hatred. To objects which suggest neither pleasure nor pain, and are apprehended of no use to procure one or ward off the other, we feel neither desire nor aversion; and such objects are called indifferent. Those objects which do not of themselves produce pleasure or pain, but are the means of procuring either, we call useful or noxious. Towards them we are affected in a subordinate manner, or with an indirect and reflective rather than a direct and immediate affection. All the original and particular affections of our nature lead us out to and ultimately rest in the first kind of objects, viz. those which give immediate pleasure, and which we therefore call good, directly so. The calm affection of self-love alone is conversant about such objects as are only consequentially good, or merely useful to ourselves.

Moral good.

But, besides those sorts of objects which we call good merely and solely as they give pleasure, or are means of procuring it, there is an higher and nobler species of good, towards which we feel that peculiar movement we call approbation or moral complacency, and which we therefore denominate moral good. Such are our affections, and the consequent actions to them. The perception of this is, as has been already observed, quite distinct in kind from the perception of the other species; and though it may be connected with pleasure or advantage by the benevolent constitution of nature, yet it constitutes a good independent of that pleasure and that advantage, and far superior not in degree only, but in dignity, to both. The other, viz. the natural good, consists in obtaining those pleasures which are adapted to the peculiar senses and passions susceptible of them, and is as various as are those senses and passions. This, viz. the moral good, lies in the right conduct

conduct of the several senses and passions, or their just proportion and accommodation to their respective objects and relations; and this is of a more simple and invariable kind.

Human happiness.

By our several senses we are capable of a great variety of pleasing sensations. These constitute distinct ends, or objects ultimately pursuable for their own sake. To these ends, or ultimate objects, correspond peculiar appetites or affections, which prompt the mind to pursue them. When these ends are attained, there it rests, and looks no farther. Whatever therefore is pursuable, not on its own account, but as subservient or necessary to the attainment of something else that is intrinsically valuable for its own sake, be that value ever so great, or ever so small, we call a mean and not an end. So that ends, and not means, constitute the materials or the very essence of our happiness. Consequently happiness, *i. e.* human happiness, cannot be one simple uniform thing, in creatures constituted as we are, with such various senses of pleasure, or such different capacities of enjoyment. Now the same principle, or law of our nature, which determines us to pursue any one end or species of good, prompts us to pursue every other end or species of good of which we are susceptible, or to which our maker has adapted an original propension. But, amidst the great multiplicity of ends or goods which form the various ingredients of our happiness, we perceive an evident gradation or subordination, suited to that gradation of senses, powers, and passions, which prevails in our mixed and various constitution, and to that ascending series of connections which open upon us in the different stages of our progressive state.

Gradation of goods.

Thus the goods of the body, or of the external senses, seem to hold the lowest rank in this gradation or scale of goods. These we have in common

mon with the brutes; and though many men are brutish enough to pursue the goods of the body with more than brutal fury, yet, when at any time they come in competition with goods of an higher order, the unanimous verdict of mankind, by giving the last the preference, condemns the first to the meanest place. Goods consisting in exterior social connections, as fame, fortune, power, civil authority, seem to succeed next, and are chiefly valuable as the means of procuring natural or moral good, but principally the latter. Goods of the intellect are still superior, as taste, knowledge, memory, judgment, &c. The highest are moral goods of the mind, directly and ultimately regarding ourselves, as command of the appetites and passions, prudence, fortitude, benevolence, &c. These are the great objects of our pursuit, and the principal ingredients of our happiness. Let us consider each of them as they rise one above the other in this natural series or scale, and touch briefly on our obligations to pursue them.

The brevity of this work will not permit us minutely to weigh the real or comparative moment of the different kinds of goods which offer themselves to the mind, or to scrutinize the particular pleasures of which we are susceptible, either as to intenseness or duration, and the enjoyment of which depends on accidents rather than our own attention and industry. We shall therefore confine ourselves to the consideration of such goods as lie properly within our own sphere, and, being the objects of our attention and care, fall within the verge of duty.

Goods of the body.

Those of the body are health, strength, agility, hardiness, and patience of change, neatness, and decency.

Good health.

Good health and a regular easy flow of spirits are in themselves sweet natural enjoyments, a great fund of pleasure, and indeed the proper

seasoning

seasoning which gives a flavour and poignancy to every other pleasure. The want of health unfits us for most duties of life, and is especially an enemy to the social and human affections, as it generally renders the unhappy sufferer peevish and sullen, disgusted at the allotments of Providence, and consequently apt to entertain suspicious and gloomy sentiments of its author. It obstructs the free exercise and full improvement of our reason, makes us a burden to our friends, and useless to society. Whereas the uninterrupted enjoyment of good health is a constant source of good humour, and good humour is a great friend to openness and benignity of heart, enables us to encounter the various ills and disappointments of life with more courage, or to sustain them with more patience; and, in short, conduces much, if we are otherwise duly qualified, to our acting our part in every exigency of life with more firmness, consistency, and dignity. Therefore it imports us much to preserve and improve an habit of enjoyment, without which every other external entertainment is tasteless, and most other advantages of little avail. And this is best done by a strict temperance in diet and regimen, by regular exercise, and by keeping the mind serene and unruffled by violent passions, and unsubdued by intense and constant labours, which greatly impair and gradually destroy the strongest constitutions.

How preserved.

Strength, agility, &c.

Strength, agility, hardiness, and patience of change, suppose health, and are unattainable without it; but they imply something more, and are necessary to guard it, to give us the perfect use of life and limbs, and to secure us against many otherwise unavoidable ills. The exercise of the necessary manual and of most of the elegant arts of life, depends on strength and agility of body; personal dangers, private and public dangers, the demands of our friends, our families, and country require them; they are necessary in war, and ornamental

ornamental in peace; fit for the employments of a country and a town life, and they exalt the entertainments and diversions of both. They are chiefly obtained by moderate and regular exercise.

How attained.

Patience of change.

Few are so much raised above want and dependence, or so exempted from business and care, as not to be often exposed to inequalities and changes of diet, exercise, air, climate, and other irregularities. Now what can be so effectual to secure one against the mischiefs arising from such unavoidable alterations, as hardiness, and a certain versatility of constitution which can bear extraordinary labours, and submit to great changes, without any sensible uneasiness or bad consequences? This is best attained, not by an over-great delicacy and minute attention to forms, or by an invariable regularity in diet, hours, and way of living, but rather by a bold and discreet latitude of regimen. Besides, deviations from established rules and forms of living, if kept within the bounds of sobriety and reason, are friendly to thought and original sentiments, animate the dull scene of ordinary life and business, and agreeably stir the passions, which stagnate or breed ill-humour in the calms of life.

How attained.

Neatness, decency, &c.

Neatness, cleanliness, and decency, to which we may add dignity of countenance and demeanour, seem to have something refined and moral in them: at least we generally esteem them indications of an orderly, genteel, and well-governed mind, conscious of an inward worth, or the respect due to one's nature. Whereas nastiness, slovenliness, aukwardness, and indecency, are shrewd symptoms of something mean, careless, and deficient, and betray a mind untaught, illiberal, unconscious of what is due to one's self or to others. How much cleanliness conduces to health, needs hardly to be mentioned; and how necessary it is to maintain one's

character and rank in life, and to render us agreeable to others as well as to ourselves, is as evident.—There are certain motions, airs, and gestures, which become the human countenance and form, in which we perceive a comeliness, openness, simplicity, gracefulness; and there are others, which to our sense of decorum appear uncomely, affected, disingenuous, and aukward, quite unsuitable to the native dignity of our face and form. The first are in themselves the most easy, natural, and commodious, give one boldness and presence of mind, a modest assurance, an address both awful and alluring; they bespeak candour and greatness of mind, raise the most agreeable prejudices in one's favour, render society engaging, command respect, and often love, and give weight and authority both in conversation and business; in fine, they are the colouring of virtue, which shew it to the greatest advantage in whomsoever it is; and not only imitate, but in some measure supply it where it is wanting. Whereas the last, viz. rudeness, affectation, indecorum, and the like, have all the contrary effects; they are burdensome to one's self, a dishonour to our nature, and a nuisance in society. The former qualities or goods are best attained by a liberal education, by preserving a just sense of the dignity of our nature, by keeping the best and politest company, but, above all, by acquiring those virtuous and ennobling habits of mind which are decency in perfection, which will give an air of unaffected grandeur, and spread a lustre truly engaging over the whole form and deportment.

How attained.

Goods of exterior social connections.

We are next to consider those goods which consist in exterior social connection, as fame, fortune, civil authority, power.

Fame.

The first has a two-fold aspect, as a good pleasant in itself, or gratifying to an original passion,

passion, and then as expedient or useful towards a farther end. Honour from the wise and good, on the account of a virtuous conduct, is regaling to a good man; for then his heart re-echoes to the grateful sound. There are few quite indifferent even to the commendation of the vulgar. Though we cannot approve that conduct which proceeds entirely from this principle, and not from good affection or love of the conduct itself, yet, as it is often a guard and additional motive to virtue in creatures imperfect as we are, and often distracted by interfering passions, it might be dangerous to suppress it altogether, however wise it may be to restrain it within due bounds, and however laudable to use it only as a scaffolding to our virtue, which may be taken down when that glorious structure is finished, but hardly till then. To pursue fame for itself, is innocent; to regard it only as an auxiliary to virtue, is noble; to seek it chiefly as an engine of public usefulness, is still more noble, and highly praiseworthy. For though the opinion and breath of men are transient and fading things, often obtained without merit, and lost without cause; yet as our business is with men, and as our capacity of serving them is generally increased in proportion to their esteem of us, therefore sound and well established moral applause may, and will be modestly, not ostentatiously, sought after by the good; not indeed as a solitary refined sort of luxury, but as a public and proper instrument to serve and bless mankind. At the same time they will learn to despise that reputation which is founded on rank, fortune, and any other circumstances or accomplishments that are foreign to real merit, or to useful services done to others, and think that praise of little avail which is purchased without desert, and bestowed without judgment.

Fortune, power, and civil authority, or whatever is called influence and weight among mankind, Fortune, power, &c.

kind, are goods of the second division, that is, valuable and pursuable only as they are useful, or as means to a farther end, viz. procuring or preserving the immediate objects of enjoyment or happiness to ourselves or others. Therefore to love such goods on their own account, and to pursue them as ends, not the means of enjoyment, must be highly preposterous and absurd. There can be no measure, no limit, to such pursuit; all must be whim, caprice, extravagance. Accordingly such appetites, unlike all the natural ones, are increased by possession, and whetted by enjoyment. They are always precarious, and never without fears, because the objects lie without one's self; they are seldom without sorrow and vexation, because no accession of wealth or power can satisfy them. But if those goods are considered only as the materials or means of private or public happiness, then the same obligations which bind us to pursue the latter, bind us likewise to pursue the former. We may, and no doubt we ought, to seek such a measure of wealth as is necessary to supply all our real wants, to raise us above servile dependence, and provide us with such conveniences as are suited to our rank and condition in life. To be regardless of this measure of wealth, is to expose ourselves to all the temptations of poverty and corruption; to forfeit our natural independency and freedom; to degrade, and consequently to render the rank we hold, and the character we sustain in society, useless, if not contemptible. When these important ends are secured, we ought not to murmur or repine that we possess no more; yet we are not secluded by any obligation, moral or divine, from seeking more, in order to give us that happiest and most god-like of all powers, the power of doing good. A supine indolence in this respect is both absurd and criminal, absurd, as it robs us of an inexhausted fund of the most refined and durable enjoyments; and

How far pursuable.

and criminal, as it renders us so far useless to the society to which we belong. "That pursuit of wealth which goes beyond the former end, viz. the obtaining the necessaries, or such conveniences of life, as, in the estimation of reason, not of vanity or passion, are suited to our rank and condition, and yet is not directed to the latter, viz. the doing good is what we call avarice." And "that pursuit of power, which, after securing one's self, *i. e.* having attained the proper independence and liberty of a rational social creature, is not directed to the good of others, is what we call ambition, or the lust of power." To what extent the strict measures of virtue will allow us to pursue either wealth or power, and civil authority, is not perhaps possible precisely to determine. That must be left to prudence, and the peculiar character, condition, and other circumstances of each man. Only thus far a limit may be set, that the pursuit of either must encroach upon no other duty or obligation which we owe to ourselves, to society, or to its parent and head. The same reasoning is to be applied to power as to wealth. It is only valuable as an instrument of our own security, and of the free enjoyment of those original goods it may, and often does, administer to us, and as an engine of more extensive happiness to our friends, our country, and mankind. In this degree it may, and unless a greater good forbids it, ought to be sought after; and when it is either offered to us, or may be obtained consistently with a good conscience, it would be criminal to decline it, and a selfish indolence to neglect the necessary means of acquiring it.

Avarice.

Ambition.

How fame and power are attained.

Now the best, and indeed the only way to obtain a solid and lasting fame, is an uniform inflexible course of virtue, the employing one's ability and wealth in supplying the wants, and using one's power in promoting or securing the happiness, the rights and liberties

berties of mankind, joined to an universal affability and politeness of manners. And surely one will not mistake the matter much, who thinks the same course conducive to the acquiring greater accessions both of wealth and power; especially if he adds to those qualifications a vigorous industry, a constant attention to the characters and wants of men, to the conjunctures of times, and continually-varying genius of affairs; and a steady intrepid honesty, that will neither yield to the allurements, nor be over-awed with the terrors of that corrupt and corrupting scene in which we live. We have sometimes heard indeed of other ways and means, as fraud, dissimulation, servility, and prostitution, and the like ignoble arts, by which the men of the world (as they are called, shrewd politicians, and men of address!) amass wealth, and procure power: but as we want rather to form a man of virtue, an honest, contented, happy man, we leave to the men of the world their own ways, and permit them, unenvied and unimitated by us, to reap the fruit of their doings.

Good of the intellect.

The next species of objects in the scale of good, are the goods of the intellect, as knowledge, memory, judgment, taste, sagacity, docility, and whatever else we call intellectual virtues. Let us consider them a little, and the means as well as obligations to improve them.

Their moment.

As man is a rational creature, capable of knowing the differences of things and actions—as he not only sees and feels what is present, but remembers what is past, and often foresees what is future;—as he advances from small beginnings, by slow degrees, and with much labour and difficulty, to knowledge and experience:—as his opinions sway his passions,—as his passions influence his conduct,—and as his conduct draws consequences after it, which extend not only to the present,

sent, but to the future time, and therefore is the principal source of his happiness or misery; it is evident, that he is formed for intellectual improvements, and that it must be of the utmost consequence for him to improve and cultivate his intellectual powers, on which those opinions, those passions, and that conduct depend*.

The pleasures they give.

But, besides the future consequences and moment of improving our intellectual powers, their immediate exercise on their proper objects yields the most rational and refined pleasures. Knowledge, and a right taste in the arts of imitation and design, as poetry, painting, sculpture, music, architecture, afford not only an innocent, but a most sensible and sublime entertainment. By these the understanding is instructed in ancient and modern life, the history of men and things, the energies and effects of the passions, the consequences of virtue and vice; by these the imagination is at once entertained and nourished with the beauties of nature and art, lighted up and spread out with the novelty, grandeur, and harmony of the universe; and, in fine, the passions are agreeably roused, and suitably engaged, by the greatest and most interesting objects that can fill the human mind. He who has a taste formed to these ingenious delights, and plenty of materials to gratify it, can never want the most agreeable exercise and entertainment, nor once have reason to make that fashionable complaint of the tediousness of time. Nor can he want a proper subject for the discipline and improvement of his heart. For, being daily conversant with beauty, order, and design, in inferior subjects, he bids fair for growing in due time an admirer of what is fair and well-proportioned in the conduct of life and the order of society, which is only order and design exerted in their highest

Knowledge and taste.

* Vid. Philos. Sinic. Confuc. lib. I. §. 3, 4, &c.

subject. He will learn to transfer the numbers of poetry to the harmony of the mind and of well-governed passions; and, from admiring the virtues of others in moral paintings, come to approve and imitate them himself. Therefore to cultivate a true and correct taste, must be both our interest and our duty, when the circumstances of our station give leisure and opportunity for it, and when the doing it is not inconsistent with our higher obligations or engagements to society and mankind.

How attained. It is best attained by reading the best books, where good sense has more the ascendant than learning, and which pertain more to practice than to speculation; by studying the best models, *i. e.* those which profess to imitate nature most, and approach the nearest to it, and by conversing with men of the most refined taste, and the greatest experience in life.

Moment of intellectual goods. As to the other intellectual goods, what a fund of entertainment must it be to investigate the truth and various relations of things, to trace the operations of nature to general laws, to explain by these its manifold phænomena, to understand that order by which the universe is upheld, and that œconomy by which it is governed; to be acquainted with the human mind, the connections, subordinations, and uses of its powers, and to mark their energy in life! How agreeable to the ingenious inquirer, to observe the manifold relations and combinations of individual minds in society, to discern the causes why they flourish or decay; and from thence to ascend, through the vast scale of beings, to that general mind which presides over all, and operates unseen in every system and in every age, through the whole compass and progression of nature! Devoted to such entertainments as these, the contemplative have abandoned every other pleasure, retired from the body, so to speak, and sequestered themselves from social intercourse; for

these,

these, the busy have often preferred to the hurry and din of life the calm retreats of contemplation; for these, when once they came to taste them, even the gay and voluptuous have thrown up the lawless pursuits of sense and appetite, and acknowledged these mental enjoyments to be the most refined, and indeed the only luxury. Besides, by a just and large knowledge of nature, we recognize the perfections of its author: and thus piety, and all those pious affections which depend on just sentiments of his character, are awakened and confirmed; and a thousand superstitious fears, that arise from partial views of his nature and works, will of course be excluded. An extensive prospect of human life, and of the periods and revolutions of human things, will conduce much to the giving a certain greatness of mind, and a noble contempt to those little competitions about power, honour, and wealth, which disturb and divide the bulk of mankind; and promote a calm indurance of those inconveniences and ills that are common appendages of humanity. Add to all, that a just knowledge of human nature, and of those hinges upon which the business and fortunes of men turn, will prevent our thinking either too highly or too meanly of our fellow-creatures, give no small scope to the exercise of friendship, confidence and good-will, and at the same time brace the mind with a proper caution and distrust, those nerves of prudence, and give a greater mastery in the conduct of private as well as public life. Therefore, by cultivating our intellectual abilities, we shall best promote and secure our interest, and be qualified for acting our part in society with honour to ourselves, as well as advantage to mankind, consequently, to improve them to the utmost of our power is our duty; they are talents committed to us by the almighty head of society, and we are accountable to him for the use of them. But be it remembered withal, that, how engaging soever the muses

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and graces are, they are chiefly valuable as they are handmaids to usher in and set off the moral virtues, from whose service if they are ever divorced, they become retainers to the meaner passions, panders to vice, and convert men (if we may use the expression) into a refined sort of savages.

How attained.

The intellectual virtues are best improved by accurate and impartial observation, extensive reading, and unconfined converse with men of all characters, especially with those who, to private study, have joined the widest acquaintance with the world, and greatest practice in affairs; but, above all, by being much in the world, and having large dealings with mankind. Such opportunities contribute much to divest one of prejudices and a servile attachment to crude systems, to open one's views, and to give that experience on which the most useful, because the most practical knowledge is built, and from which the surest maxims for the conduct of life are deduced.

Moral goods.

The highest goods which enter into the composition of human happiness are moral goods of the mind, directly and ultimately regarding ourselves; as command of the appetites and passions, prudence and caution, magnanimity, fortitude, humility, love of virtue, love of good, resignation, and the like. These sublime goods are goods by way of eminence, goods recommended and enforced by the most intimate and awful sense and consciousness of our nature; goods that constitute the quintessence, the very temper of happiness, that form and complexion of soul which renders us approveable and lovely in the sight of God; goods, in fine, which are the elements of all our future perfection and felicity.

Their moment.

Most of the other goods we have considered depend partly on ourselves, and partly on accidents which we can neither foresee, nor prevent,

and

and result from causes which we cannot influence or alter. They are such goods as we may possess to-day and lose to-morrow, and which require a felicity of constitution, and talents to attain them in full vigour and perfection, and a felicity of conjunctures to secure the possession of them. Therefore, did our happiness depend altogether or chiefly on such transitory and precarious possessions, it were itself most precarious, and the highest folly to be anxious about it.——But though creatures, constituted as we are, cannot be indifferent about such goods, and must suffer in some degree, and consequently have our happiness incomplete without them, yet they weigh but little in the scale when compared with moral goods. By the benevolent constitution of our nature these are placed within the sphere of our activity, so that no man can be destitute of them unless he is first wanting to himself. Some of the wisest and best of mankind have wanted most of the former goods, and all the external kind, and felt most of the opposite ills, such at least as arise from without; yet by possessing the latter, viz. the moral goods, have declared they were happy, and to the conviction of the most impartial observers have appeared happy. The worst of men have been surrounded with every outward good and advantage of fortune, and have possessed great parts; yet, for want of moral rectitude, have been, and have confessed themselves, notoriously and exquisitely miserable. The exercise of virtue has supported its votaries, and made them exult in the midst of tortures almost intolerable; nay, how often has some false form or shadow of it sustained even the greatest* villains and bigots under the same pressures! But no external goods, no goods of fortune, have been able to alleviate the agonies or expel

*As Ravilliac, who assassinated Henry the fourth of France; and Balthasar Geraerd, who murdered William the first, prince of Orange.

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the fears of a guilty mind, conscious of the deserved hatred and reproach of mankind, and the just displeasure of almighty God. The other senses and capacities of enjoyment are gratified when they obtain their respective objects, and the happiness of the correspondent passions depends on their success in their several pursuits. Thus the love of honour, of pleasure, of power, and the like, are satisfied only when they obtain the desired honour, pleasure, or power: when they fail of attaining these, they are disappointed, and disappointment gives disgust. But moral good is of so singular and sublime a nature, that when the mind is in pursuit of it, though it should prove unsuccessful in its aims, it can rest in the conduct without repining, without being dejected at the ill success; nay, the pleasure attending the consciousness of upright aims and generous efforts absorbs the disappointment, and makes inferior ends disappear as of no amount in the great aggregate and surplusage of good that remains. So that though human happiness in the present state consists of many separate and little rivulets, which must often be left dry in the perpetual flux and reflux of human things, yet the main stream, with which those lesser ones do generally communicate, flows from within, from the heart of man, and if this be sound and clear, rolls on through life with a strong and equal current. Yet as many small articles make up a pretty large sum, and as those inferior goods which enter into the account, as health, fame, fortune, and the like, are often, even after our utmost care, unattainable, or at least precarious, it is evidently of the utmost consequence to be prepared against the want or loss of them, by having our desires moderate, and our passions under due command. And let it be remembered, that it is not only of great importance to our ease and security against ill, but one of the highest improvements of virtue, to contemn those things, the contempt

contempt of which is truly great and heroic, and to place our happiness chiefly in those virtuous exercises and affections which arise from a pure and well-disposed mind; an happiness which no condition of life can exclude, no change of fortune interrupt or destroy. This will arm and fortify the mind against the want of those inferior goods, and against those pains, which result to the generality of mankind from the contrary evils.

The mixed condition of human life requires particular virtues.

As the present condition of human life is wonderfully chequered with good and ill, and as no height of station, no affluence of fortune, can absolutely insure the good or secure against the ill, it is evident that a great part of the comfort and serenity of life must lie in having our minds duly affected with regard to both, *i. e.* rightly attempered to the loss of one and the sufferance of the other. For it is certain, that outward calamities derive their chief malignity and pressure from the inward dispositions with which we receive them. By managing these right, we may greatly abate that malignity and pressure, and consequently diminish the number, and weaken the moment, of the ills of life, if we should not have it in our power to obtain a large share of its goods. There are particularly three virtues which go to the forming this right temper towards ill, and which are of singular efficacy, if not totally to remove, yet wonderfully to alleviate, the calamities of life. These are fortitude, or patience, humility, and resignation. Let us consider them a little, and the effects they produce.

Fortitude.

Fortitude is that calm and steady habit of mind which either moderates our fears, and enables us bravely to encounter the prospect of ill, or renders the mind serene and invincible under its immediate pressure. It lies equally distant from rashness and cowardice; and though it does not hinder us from feeling, yet prevents our complaining or shrinking under the stroke.

It

It always includes a generous contempt of, or at least a noble superiority to, those precarious goods of which we can insure neither the possession nor continuance. The man therefore who possesses this virtue in this ample sense of it, stands upon an eminence, and sees human things below him; the tempest indeed may reach him, but he stands secure and collected against it upon the basis of conscious virtue, which the severest storms can seldom shake, and never overthrow.

Humility. Humility is another virtue of high rank and dignity, though often mistaken by proud mortals for meanness and pusillanimity. It is opposed to pride; which commonly includes in it a false or over-rated estimation of our own merit, an ascription of it to ourselves as its only and original cause, an undue comparison of ourselves with others, and, in consequence of that supposed superiority, an arrogant preference of ourselves, and a supercilious contempt of them. Humility, on the other hand, seems to denote that modest and ingenuous temper of mind, which arises from a just and equal estimate of our own advantages compared with those of others, and from a sense of our deriving all originally from the author of our being. Its ordinary attendants are mildness, a gentle forbearance, and an easy unassuming humanity with regard to the imperfections and faults of others; virtues rare indeed, but of the fairest complexion, the proper offspring of so lovely a parent, the best ornaments of such imperfect creatures as we are, precious in the sight of God, and which sweetly allure the hearts of men.—This virtue was not altogether unknown to the more sober moralists among the ancients, who place *submissio animi* among the train of virtues; but it is taught in its highest perfection, and enforced by the greatest example and the strongest motives, in the christian religion, which recommends and exalts this, as well as every other moral and divine

divine virtue, beyond every other system of religion and philosophy that ever appeared in the world; and teaches us throughout the whole of it to refer every virtue and every endowment to their original source, the father of lights, from whom descends every good and perfect gift. Humility is a virtue which highly adorns the character in which it resides, and sets off every other virtue; it is an admirable ingredient of a contented mind, and an excellent security against many of those ills in life, which are most sensibly felt by people of a delicate nature. To be persuaded of this, we need only remember how many of our uneasinesses arise from the mortifications of our pride——how almost every ill we suffer, and all the opposition we meet with, is aggravated and sharpened by the reflection on our imaginary merit, or how little we deserved those ills, and how much we were intitled to the opposite goods. Whereas a sober sense of what we are and whose we are, and a consciousness how far short our virtue is of that standard of perfection to which we ought to aspire, will blunt the edge of injuries and affronts, and make us sit down contented with our share of the goods, and easy under the ills of life, which this quick-sighted unassuming virtue will teach us often to trace to our own misconduct, and consequently to interpret as the just and wholsome correction of heaven.

Resignation. Resignation is that mild and heroic temper of mind, which arises from a sense of an infinitely wise and good Providence, and enables one to acquiesce with a cordial affection in its just appointments. This virtue has something very peculiar in its nature, and sublime in its efficacy. For it teaches us to bear ill not only with patience and as being unavoidable, but it transforms, as it were, ill into good, by leading us to consider it, and every event that has the least appearance of ill, as a divine dispensation, a wise and benevolent tempera-

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ment of things, subservient to universal good, and, of course, including that of every individual, especially of such as calmly stoop to it. In this light, the administration itself, nay, every act of it, becomes an object of affection, the evil disappears, or is converted into a balm which both heals and nourishes the mind. For, though the first unexpected access of ill may surprise the soul into grief, yet that grief, when the mind calmly reviews its object, changes into contentment, and is by degrees exalted into veneration and a divine composure. Our private will is lost in that of the Almighty, and our security against every real ill rests on the same bottom as the throne of him who lives and reigns for ever. He, therefore, who is provided with such armour, taken, if we may say so, from the armoury of heaven, may be proof against the sharpest arrows of fortune, and defy the impotence of human malice; and though he cannot be secure against those ills which are the ordinary appendages of man's lot, yet may possess that quiet, contented mind, which takes off their pungency, and is next to an exemption from them. But we can only touch on these things; a fuller detail of our obligations to cultivate and pursue these moral goods of the mind, and the best method of doing it, must be reserved to another and more proper place.

Chief good, objective and formal. Before we finish this section, it may be fit to observe, that as the Deity is the supreme and inexhausted source of good, on whom the happiness of the whole creation depends; as he is the highest object in nature, and the only object who is fully proportioned to the intellectual and moral powers of the mind, in whom they ultimately rest and find their most perfect exercise and completion, he is therefore termed the chief good of man, objectively considered. And virtue, or the proportioned and vigorous exercise of the several powers and affections on their respective objects, as above described, is

is, in the schools, termed the chief good, formally considered, or its formal idea, being the inward temper and native constitution of human happiness.

From the detail we have gone through, the following corollaries may be deduced:—

Corollaries.

1. It is evident that the happiness of such a progressive creature as man can never be at a stand, or continue a fixed invariable thing. His finite nature, let it rise ever so high, admits still higher degrees of improvement and perfection. And his progression in improvement or virtue always makes way for a progression in happiness. So that no possible point can be assigned in any period of his existence in which he is perfectly happy, that is, so happy as to exclude higher degrees of happiness. All his perfection is only comparative. 2. It appears that many things must conspire to complete the happiness of so various a creature as man, subject to so many wants, and susceptible of such different pleasures. 3. As his capacities of pleasure cannot be all gratified at the same time, and must often interfere with each other in such a precarious and fleeting state as human life, or be frequently disappointed, perfect happiness, *i. e.* the undisturbed enjoyment of the several pleasures of which we are capable, is unattainable in our present state. 4. That state is most to be sought after, in which the fewest competitions and disappointments can happen, which least of all impairs any sense of pleasure, and opens an inexhausted source of the most refined and lasting enjoyments. 5. That state which is attended with all those advantages, is a state or course of virtue. 6. Therefore, a state of virtue, in which the moral goods of the mind are attained, is the happiest state.

SECTION III.

DUTIES TO SOCIETY.

CHAP. I.

Filial and Fraternal Duty.

AS we have followed the order of nature in tracing the history of man, and those duties which he owes to himself, it seems reasonable to take the same method with those he owes to society, which constitute the second class of his obligations.

Connection of Parents.

His parents are among the earliest objects of his attention; he becomes soonest acquainted with them, reposes a peculiar confidence in them, and seems to regard them with a fond affection, the early prognostics of his future piety and gratitude. Thus does nature dictate the first lines of filial duty, even before a just sense of the connection is formed. But when the child is grown up, and has attained to such a degree of understanding, as to comprehend the moral tie, and be sensible of the obligations he is under to his parents; when he looks back on their tender and disinterested affection, their incessant cares and labours in nursing, educating, and providing for him, during that state in which he had neither prudence nor strength to care and provide for himself, he must be conscious that he owes to them these peculiar duties.

Duties to parents.

To reverence and honour them, as the instruments of nature in introducing him to life, and to that state of comfort and happiness which he enjoys; and therefore to esteem and imitate their good qualities, to alleviate and bear with, and spread, as much as possible, a decent veil over their faults and weaknesses.

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2. To be highly grateful to them, for those favours which it can hardly ever be in his power fully to repay; to shew this gratitude by a strict attention to their wants, and a solicitous care to supply them; by a submissive deference to their authority and advice, especially by paying great regard to it in the choice of a wife, and of an occupation; by yielding to, rather than peevishly contending with, their humours, as remembering how oft they have been persecuted by his; and, in fine, by soothing their cares, lightening their sorrows, supporting the infirmities of age, and making the remainder of their life as comfortable and joyful as possible.—To pay these honours, and make these returns, is, according to Plato, to pay the oldest, best, and greatest of debts, next to those we owe to our Supreme and common Parent. They are founded in our nature, and agreeable to the most fundamental laws of gratitude, honour, justice, natural affection and piety, which are interwoven with our very constitution; nor can we be deficient in them without casting off that nature, and contradicting those laws.

Duties to brethren and sisters.

As his brethren and sisters are the next with whom the creature forms a social and moral connection, to them he owes a fraternal regard; and with them ought he to enter into a strict league of friendship, mutual sympathy, advice, assistance, and a generous intercourse of kind offices, remembering their relation to common parents, and that brotherhood of nature which unites them into a closer community of interest and affection.

CHAP. II.

Concerning Marriage.

Connection with the other sex.

WHEN man arrives to a certain age, he becomes sensible of a peculiar sympathy and

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tenderness towards the other sex; the charms of beauty engage his attention, and call forth new and softer dispositions than he has yet felt. The many amiable qualities exhibited by a fair outside, or by the mild allurement of female manners, or which the prejudiced spectator, without much reasoning, supposes those to include, with several other circumstances both natural and accidental, point his view and affection to a particular object, and of course contract that general rambling regard, which was lost and useless among the undistinguished crowd, into a peculiar and permanent attachment to one woman, which ordinarily terminates in the most important, venerable, and delightful connection in life.

The grounds of this connection.

The state of the brute creation is very different from that of human creatures. The former are cloathed and generally armed by their structure, easily find what is necessary to their subsistence, and soon attain their vigour and maturity; so that they need the care and aid of their parents but for a short while; and therefore we see that nature has assigned to them vagrant and transient amours. The connection being purely natural, and merely for propagating and rearing their offspring, no sooner is that end answered, than the connection dissolves of course. But the human race are of a more tender and defenceless constitution; their infancy and non-age continue longer; they advance slowly to strength of body, and maturity of reason; they need constant attention, and a long series of cares and labours, to train them up to decency, virtue, and the various arts of life. Nature has, therefore, provided them with the most affectionate and anxious tutors, to aid their weakness, to supply their wants, and to accomplish them in those necessary arts, even their own parents, on whom she has devolved this mighty charge, rendered agreeable by the most alluring and powerful of all ties, parental affection.

affection. But unless both concur in this grateful task, and continue their joint labours, till they have reared up and planted out their young colony, it must become a prey to every rude invader, and the purpose of nature in the original union of the human pair be defeated. Therefore our structure as well as condition is an evident indication, that the human sexes are destined for a more intimate, for a moral and lasting union. It appears likewise, that the principal end of marriage is not to propagate and nurse up an offspring, but to educate and form minds for the great duties and extensive destinations of life. Society must be supplied from this original nursery with useful members, and its fairest ornaments and supports. But how shall the young plants be guarded against the inclemencies of the air and seasons, cultivated and raised to maturity, if men, like brutes, indulge to vagrant and promiscuous amours?

Moral ends of marriage.

The mind is apt to be dissipated in its views and acts of friendship and humanity; unless the former be directed to a particular object, and the latter employed in a particular province. When men once indulge to this dissipation, there is no stopping their career, they grow insensible to moral attractions, and, by obstructing or impairing the decent and regular exercise of the tender and generous feelings of the human heart, they in time become unqualified for, or averse to, the forming a moral union of souls, which is the cement of society, and the source of the purest domestic joys. Whereas a rational, undepraved love, and its fair companion, marriage, collect a man's views, guide his heart to its proper object, and, by confining his affection to that object, do really enlarge its influence and use. Besides, it is but too evident from the conduct of mankind, that the common ties of humanity are too feeble to engage and interest the passions of the generality in the affairs

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of society. The connections of neighbourhood, acquaintance, and general intercourse, are too wide a field of action for many, and those of a public or community are so far more, and in which they either care not, or know not how to exert themselves. Therefore nature, ever wise and benevolent, by implanting that strong sympathy which reigns between the individuals of each sex, and by urging them to form a particular moral connection, the spring of many domestic endearments, has measured out to each pair a particular sphere of action, proportioned to their views, and adapted to their respective capacities. Besides, by interesting them deeply in the concerns of their own little circle, she has connected them more closely with society, which is composed of particular families, and bound them down to their good behaviour in that particular community to which they belong. This moral connection is marriage, and this sphere of action is a family. It appears from what has been said, that to adult persons, who have fortune sufficient to provide for a family according to their rank and condition in life, and who are endued with the ordinary degrees of prudence necessary to manage a family, and educate children, it is a duty they owe to society, to marry.

An objection answered. Some pretenders to a peculiar refinement in morals think, however, that a single state is more conducive to the perfection of our nature, and to those sublime improvements to which religion calls us. Sometimes, indeed, the more important duties we owe to the public, which could scarce be performed, or not so well, in the married state, may require the single life, or render the other not so honourable a station in such circumstances; but, surely, it must be improving to the social affections to direct them to particular objects whom we esteem, and to whom we stand in the nearest relation, and

and to ascertain their exercise in a field of action which is both agreeable in itself, and highly advantageous to society. The constant exercise of natural affection, in which one is necessarily engaged in providing for and training up one's children, opens the heart, and must enure the mind to frequent acts of self-denial and self-command, and consequently strengthen the habits of goodness. The truth of this is but too evident in those married persons who are so unfortunate as to have no children, who for want of those necessary exercises of humanity, are too generally over anxious about the world, and perhaps too attentive to the affair of œconomy. Another circumstance deserves to be remembered, that men who are continually engaged in study or business, or anxiously intent on public concerns, are apt to grow stern and severe, or peevish and morose, on account of the frequent rubs they meet with, or fatigues they undergo in such a course. The female softness is therefore useful to moderate their severity, and change their ill-humour into domestic tenderness, and a softer kind of humanity. And thus their minds, which were over-strained by the intenseness of their application, are at once relaxed and re-tuned for public action. The minds of both sexes are as much formed one for the other, by a temperament peculiar to each, as their persons. The strength, firmness, courage, gravity, and dignity of the man, tally to the softness, delicacy, tenderness of passion, elegance of taste, and decency of conversation of the woman. The male mind is formed to defend, deliberate, foresee, contrive, and advise. The female one to confide, imagine, apprehend, comply, and execute. Therefore the proper temperament of these different sexes of minds makes a fine moral union; and the well-proportioned opposition of different or contrary qualities, like a due mixture of discords in a composition of music, swells

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the harmony of society more than if they were all unisons to each other. And this union of moral sexes, if we may express it so, is evidently more conducive to the improvement of each, than if they lived apart. For the man not only protects and advises, but communicates vigour and resolution to the woman. She in her turn softens, refines, and polishes him. In her society, he finds repose from action and care; in her friendship, the ferment, into which his passions were wrought by the hurry and distraction of public life, subsides and settles into a calm; and a thousand nameless graces and decencies, that flow from her words and actions, form him for a more mild and elegant deportment. His conversation and example on the other hand, enlarge her views, raise her sentiments, sustain her resolutions, and free her from a thousand fears and inquietudes, to which her more feeble constitution subjects her. Surely such dispositions, and the happy consequences which result from them, cannot be supposed to carry an unfriendly aspect to any duty he owes either to God or to man.

Duties of marriage.

Of the conjugal alliance the following are the natural laws. First, mutual fidelity to the marriage-bed. Disloyalty defeats the very end of marriage, dissolves the natural cement of the relation, weakens the moral tie, the chief strength of which lies in the reciprocation of affection, and, by making the offspring uncertain, diminishes the care and attachment necessary to their education.

2. A conspiration of counsels and endeavours to promote the common interest of the family, and to educate their common offspring. In order to observe these laws, it is necessary to cultivate, both before and during the married state, the strictest decency and chastity of manners, and a just sense of what becomes their respective characters.

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3. The union must be inviolable, and for life. The nature of friendship, and particularly of this species of it, the education of their offspring, and the order of society and of successions, which would otherwise be extremely perplexed, do all seem to require it. To preserve this union, and render the matrimonial state more harmonious and comfortable, a mutual esteem and tenderness, a mutual deference and forbearance, a communication of advice, and assistance and authority are absolutely necessary. If either party keep within their proper departments, there need be no disputes about power or superiority, and there will be none. They have no opposite, no separate interests, and therefore there can be no just ground for opposition of conduct.

Polygamy.

From this detail, and the present state of things, in which there is pretty near a parity of numbers of both sexes, it is evident that polygamy is an unnatural state; and though it should be granted to be more fruitful of children, which however it is not found to be, yet it is by no means so fit for rearing minds, which seems to be as much, if not more, the intention of nature than the propagation of bodies.

Divorce, &c.

In what cases divorce may be proper, what are the just obstacles of marriage, and within what degrees of consanguinity it may be allowed, we have not room to discuss here; and therefore we refer the reader to Mr. Hutcheson's ingenious Moral Compend. Book III. Chap. 1.

CHAP. III.

Of Parental Duty.

Connection of parents and children.

THE connection of parents with their children is a natural consequence of the matrimo-

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nial connection, and the duties which they owe them result as naturally from that connection. The feeble state of children, subject to so many wants and dangers, requires their incessant care and attention; their ignorant and uncultivated minds demand their continual instruction and culture. Had human creatures come into the world with the full strength of men, and the weakness of reason and vehemence of passions which prevail in children, they would have been too strong or too stubborn to have submitted to the government and instruction of their parents. But as they were designed for a progression in knowledge and virtue, it was proper that the growth of their bodies should keep pace with that of their minds, lest the purposes of that progression should have been defeated. Among other admirable purposes which this gradual expansion of their outward as well as inward structures serves, this is one, that it affords ample scope to the exercise of many tender and generous affections, which fill up the domestic life with a beautiful variety of duties and enjoyments; and are of course a noble discipline for the heart, and an hardy kind of education for the more honourable and important duties of public life.

The authority founded on that connection.

The above-mentioned weak and ignorant state of children, seems plainly to invest their parents with such authority and power as is necessary to their support, protection, and education; but that authority and power can be construed to extend no farther than is necessary to answer those ends, and to last no longer than that weakness and ignorance continue; wherefore, the foundation or reason of the authority and power ceasing, they cease of course. Whatever power or authority then it may be necessary or lawful for parents to exercise during the non-age of their children, to assume or usurp the same when they have attained the maturity or

or full exercise of their strength and reason, would be tyrannical and unjust. From hence it is evident, that parents have no right to punish the persons of their children more severely than the nature of their wardship requires, much less to invade their lives, to encroach upon their liberty, or transfer them as their property to any master whatsoever. But if any parent should be so unjust and inhuman, as to consider and treat them like his other goods and chattels, surely, whenever they dare, they may resist, and, whenever they can, shake off that inhuman and unnatural yoke, and be free with that liberty with which God and nature invest them.

Duties of parents.

The first class of duties which parents owe their children respect their natural life; and these comprehend protection, nurture, provision, introducing them into the world in a manner suitable to their rank and fortune, and the like.

Education.

The second order of duties regards the intellectual and moral life of their children, or their education in such arts and accomplishments as are necessary to qualify them for performing the duties they owe to themselves and to others. As this was found to be the principal design of the matrimonial alliance, so the fulfilling that design is the most important and dignified of all the parental duties. In order therefore to fit the child for acting his part wisely and worthily, as a man, as a citizen, and a creature of God, both parents ought to combine their joint wisdom, authority, and power, and each apart to employ those talents which are the peculiar excellency and ornament of their respective sex. The father ought to lay out and superintend their education, the mother to execute and manage the detail of which she is capable. The former should direct the manly exertion of the intellectual and moral powers of his child. His imagination, and the manner of those exertions, are the

the peculiar province of the latter. The former should advise, protect, command, and, by his experience, masculine vigour, and that superior authority which is commonly ascribed to his sex, brace and strengthen his pupil for active life, for gravity, integrity, and firmness in suffering. The business of the latter is to bend and soften her male pupil, by the charms of her conversation, and the softness and decency of her manners, for social life, for politeness of taste, and the elegant decorums and enjoyments of humanity; and to improve and refine the tenderness and modesty of her female pupil, and form her to all those mild domestic virtues which are the peculiar characteristics and ornaments of her sex.

> Delightful task! to rear the tender thought,
> To teach the fair idea how to shoot;
> To breathe th' enliv'ning spirit, and to fix
> The generous purpose in the glowing breast.

To conduct the opening minds of their sweet charge through the several periods of their progress, to assist them in each period, in throwing out the latent seeds of reason and ingenuity, and in gaining fresh accessions of light and virtue; and at length, with all these advantages, to produce the young adventurers upon the great theatre of human life, to play their several parts in the sight of their friends, of society, and mankind! How gloriously does heaven reward the task, when the parents behold those near images and representatives of themselves inheriting their virtues as well as fortunes, sustaining their respective characters gracefully and worthily, and giving them the agreeable prospect of transmitting their name with growing honour and advantage to a race yet unborn!

CHAP.

CHAP. IV.

Herile and Servile Duty.

The ground of this connection.

IN the natural course of human affairs it must necessarily happen, that some of mankind will live in plenty and opulence, and others be reduced to a state of indigence and poverty. The former need the labours of the latter, and the latter the provision and support of the former. This mutual necessity is the foundation of that connection, whether we call it moral or civil, which subsists between masters and servants. He who feeds another has a right to some equivalent, the labour of him whom he maintains, and the fruits of it. And he who labours for another has a right to expect that he should support him. But as the labours of a man of ordinary strength, are certainly of greater value than mere food and cloathing; because they would actually produce more, even the maintenance of a family, were the labourer to employ them in his own behalf; therefore he has an undoubted right to rate and dispose of his service for certain wages above mere maintenance; and if he has incautiously disposed of it for the latter only, yet the contract being of the onerous kind, he may equitably claim a supply of that deficiency. If the service be specified, the servant is bound to that only; if not, then he is to be construed as bound only to such services as are consistent with the laws of justice and humanity. By the voluntary servitude to which he subjects himself, he forfeits no rights but such as are necessarily included in that servitude, and is obnoxious to no punishment but such as a voluntary failure in the service may be supposed reasonably to require. The offspring of such servants have a right to that liberty, which neither they nor their parents have forfeited.

The conditions of service.

As

The case of great offenders.

As to those who, because of some heinous offence, or for some notorious damage, for which they cannot otherwise compensate, are condemned to perpetual service, they do not, on that account, forfeit all the rights of men; but those, the loss of which is necessary to secure society against the like offences for the future, or to repair the damage they have done.

The case of captives.

With regard to captives taken in war, it is barbarous and inhuman to make perpetual slaves of them, unless some peculiar and aggravated circumstances of guilt have attended their hostility. The bulk of the subjects of any government engaged in war may be fairly esteemed innocent enemies; and therefore they have a right to that clemency which is consistent with the common safety of mankind, and the particular security of that society against which they are engaged. Though ordinary captives have a grant of their lives, yet to pay their liberty as an equivalent, is much too high a price. There are other ways of acknowledging or returning the favour, than by surrendering what is far dearer than life itself*. To those who, under pretext of the necessities of commerce, drive the unnatural trade of bargaining for human flesh, and consigning their innocent but unfortunate fellow-creatures to eternal servitude and misery, we may address the words of a fine writer; "Let avarice defend it as it will, there is an honest reluctance in humanity against buying and selling, and regarding those of our own species as our wealth and possessions."

As it is the servant's duty to serve his master with fidelity and chearfulness, like one who knows he is accountable to the great Lord of the universe; so the master ought to exact nothing of his servant beyond the natural

* Vide Hutch. Mor. Inst. Phil. Lib. III. cap. 3.

limits

limits of reason and humanity, remembering that he is a brother of the same family, a partner of the same nature, and a subject of the same great Lord.

CHAP. V.

Social Duties of the private Kind.

HITHERTO we have considered only the domestic œconomical duties, because these are first in the progress of nature. But as man passes beyond the little circle of a family, he forms connections with relations, friends, neighbours, and others; from whence results a new train of duties of the more private social kind, as friendship, chastity, courtesy, good-neighbourhood, charity, forgiveness, hospitality.

Man's aptitude for society.

Man is admirably formed for particular social attachments and duties. There is a peculiar and strong propensity in his nature to be affected with the sentiments and dispositions of others. Men, like certain musical instruments, are set to each other, so that the vibrations or notes excited in one, raise correspondent notes and vibrations in the others. The impulses of pleasure or pain, joy or sorrow, made on one mind, are by an instantaneous sympathy of nature communicated in some degree to all; especially when hearts are (as an humane writer expresses it) in unison of kindness; the joy that vibrates in one communicates to the other also. We may add, that though joy thus imparted swells the harmony, yet grief vibrated to the heart of a friend, and rebounding from thence in sympathetic notes, melts as it were, and almost dies away. All the passions, but especially those of the social kind, are contagious; and when the passions of one man mingle with those of another,

they increase and multiply prodigiously. There is a most moving eloquence in the human countenance, air, voice, and gesture, wonderfully expressive of the most latent feelings and passions of the soul, which darts them like a subtle flame into the hearts of others, and raises correspondent feelings there: friendship, love, good-humour, joy, spread through every feature, and particularly shoot from the eyes their softer and fiercer fires with an irresistible energy. And in like manner the opposite passions of hatred, enmity, ill-humour, melancholy, diffuse a sullen and saddening air over the face, and, flashing from eye to eye, kindle a train of similar passions. By these, and other admirable pieces of machinery, men are formed for society and the delightful interchange of friendly sentiments and duties, to increase the happiness of others by participation, and their own by rebound; and to diminish, by dividing, the common stock of their misery.

Duties arising from private relation.

The first emanations of the social principle, beyond the bounds of a family, lead us to form a nearer conjunction of friendship or goodwill with those who are any-wise connected with us by blood, or domestic alliance. To them our affection does commonly exert itself in a greater or less degree, according to the nearness or distance of the relation. And this proportion is admirably suited to the extent of our powers and the indigence of our state; for it is only within those lesser circles of consanguinity or alliance, that the generality of mankind are able to display their abilities or benevolence, and consequently to uphold their connection with society, and subserviency to a public interest. Therefore it is our duty to regard these closer connections as the next department to that of a family, in which nature has marked out for us a sphere of activity and usefulness; and to cultivate the kind affections which are the cement of those endearing alliances.

Frequently

Ingredients of friendship.

Frequently the view of distinguishing moral qualities in some of our acquaintance may give birth to that more noble connection we call friendship, which is far superior to the alliances of consanguinity. For these are of a superficial, and often of a transitory nature, of which, as they hold more of instinct, than of reason, we cannot give such a rational account. But friendship derives all its strength and beauty, and the only existence which is durable, from the qualities of the heart, or from virtuous and lovely dispositions. Or, should these be wanting, they or some shadow of them must be supposed present. Therefore friendship may be described to be, "the union of two souls by means of virtue, the common object and cement of their mutual affection." Without virtue, or the supposition of it, friendship is only a mercenary league, an alliance of interest, which must dissolve of course when that interest decays or subsists no longer. It is not so much any particular passion, as a composition of some of the noblest feelings and passions of the mind. Good sense, a just taste and love of virtue, a thorough candour and benignity of heart, or what we usually call a good temper, and a generous sympathy of sentiments and affections, are the necessary ingredients of this virtuous connection. When it is grafted on esteem, strengthened by habit, and mellowed by time, it yields infinite pleasure, ever new and ever growing, is a noble support amidst the various trials and vicissitudes of life, and an high seasoning to most of our other enjoyments. To form and cultivate virtuous friendship, must be very improving to the temper, as its principal object is virtue, set off with all the allurement of countenance, air and manners, shining forth in the native graces of manly honest sentiments and affections, and rendered visible as it were to the friendly spectator in a conduct unaffectedly great and good; and as its principal exercises are the very energies of virtue, or its effects and emanations. So that

 wherever

wherever this amiable attachment prevails, it will exalt our admiration and attachment to virtue, and, unless impeded in its course by unnatural prejudices, run out into a friendship to the human race. For as no one can merit, and none ought to usurp, the sacred name of friend, who hates mankind; so whoever truly loves them, possesses the most essential quality of a true friend.

Its duties. The duties of friendship are a mutual esteem of each other, unbribed by interest and independent of it, a generous confidence as far distant from suspicion as from reserve, an inviolable harmony of sentiments and dispositions, of designs and interests, a fidelity unshaken by the changes of fortune, a constancy unalterable by distance of time or place, a resignation of one's personal interests to those of one's friend, and a reciprocal, unenvious, unreserved exchange of kind offices. But, amidst all the exertions of this moral connection, humane and generous as it is, we must remember that it operates within a narrow sphere, and its immediate operations respect only the individual; and therefore its particular impulses must still be subordinate to a more public interest, or be always directed and controuled by the more extensive connections of our nature.

Love and chastity. When our friendship terminates on any of the other sex, in whom beauty or agreeableness of person, and external gracefulness of manners, conspire to express and heighten the moral charm of a tender honest heart, and sweet, ingenuous modest temper, lighted up by good sense; it generally grows into a more soft and endearing attachment. When this attachment is improved by a growing acquaintance with the worth of its object, is conducted by discretion, and issues at length, as it ought to do, in the moral connection formerly mentioned*, it becomes the source of many amiable duties,

* See chap. II. of this sect.

of

of a communication of passions and interests, of the most refined decencies, and of a thousand nameless deep-felt joys of reciprocal tenderness and love, flowing from every look, word, and action. Here friendship acts with double energy, and the natural conspires with the moral charms to strengthen and secure the love of virtue. As the delicate nature of female honour and decorum, and the inexpressible grace of a chaste and modest behaviour, are the surest and indeed the only means of kindling at first, and ever after of keeping alive, this tender and elegant flame, and of accomplishing the excellent ends designed by it; to attempt by fraud to violate one, or, under pretence of passion, to sully and corrupt the other, and, by so doing, to expose the too often credulous and unguarded object with a wanton cruelty, to the hatred of her own sex and the scorn of ours, and to the lowest infamy of both, is a conduct not only base and criminal, but inconsistent with that truly rational and refined enjoyment, the spirit and quintessence of which is derived from the bashful and sacred charms of virtue kept untainted, and therefore ever alluring to the lover's heart.

Courtesy, good neighbourhood, &c.

Courtesy, good neighbourhood, affability, and the like duties, which are founded on our private social connections, are no less necessary and obligatory to creatures united in society, and supporting and supported by each other in a chain of mutual want and dependence. They do not consist in a smooth address, an artificial or obsequious air, fawning adulations, or a polite servility of manners; but in a just and modest sense of our own dignity and that of others, and of the reverence due to mankind, especially to those who hold the higher links of the social chain; in a discreet and manly accommodation of ourselves to the foibles and humours of others; in a strict observance of the rules of decorum and civility; but, above all, in a frank obliging

obliging carriage, and generous interchange of good deeds rather than words. Such a conduct is of great use and advantage, as it is an excellent security against injury, and the best claim and recommendation to the esteem, civility, and universal respect of mankind. This inferior order of virtues unites the particular members of society more closely, and forms the lesser pillars of the civil fabric; which, in many instances, supply the unavoidable defects of laws, and maintain the harmony and decorum of social intercourse, where the more important and essential lines of virtue are wanting.

Charity, forgiveness.

Charity and forgiveness are truly amiable and useful duties of the social kind. There is a twofold distinction of rights commonly taken notice of by moral writers, viz. perfect and imperfect. To fulfil the former, is necessary to the being and support of society; to fulfil the latter, is a duty equally sacred and obligatory, and tends to the improvement and prosperity of society; but as the violation of them is not equally prejudicial to the public good, the fulfilling them is not subjected to the cognizance of law, but left to the candour, humanity, and gratitude of individuals. And by this means ample scope is given to exercise all the generosity, and display the genuine merit and lustre, of virtue. Thus the wants and misfortunes of others call for our charitable assistance and seasonable supplies. And the good man, unconstrained by law, and uncontrouled by human authority, will chearfully acknowledge and generously satisfy this mournful and moving claim; a claim supported by the sanction of heaven, of whose bounties he is honoured to be the grateful trustee. If his own perfect rights are invaded by the injustice of others, he will not therefore reject their imperfect right to pity and forgiveness, unless his grant of these should be inconsistent with the more extensive rights of society, or the public good. In that

case

case he will have recourse to public justice and the laws, and even then he will prosecute the injury with no unnecessary severity, but rather with mildness and humanity. When the injury is merely personal, and of such a nature as to admit of alleviations, and the forgiveness of which would be attended with no worse consequences, especially of a public kind, the good man will generously forgive his offending brother. And it is his duty to do so, and not to take private revenge, or retaliate evil for evil. For though resentment of injury is a natural passion, and implanted, as was observed* above, for wise and good ends; yet, considering the manifold partialities which most men have for themselves, was every one to act as judge in his own cause, and to execute the sentence dictated by his own resentment, it is but too evident that mankind would pass all bounds in their fury, and the last sufferer be provoked in his turn to make full reprisals. So that evil, thus encountering with evil, would produce one continued series of violence and misery, and render society intolerable, if not impracticable. Therefore, where the security of the individual, or the good of the public, does not require a proportionable retaliation, it is agreeable to the general law of benevolence, and to the particular end of the passion (which is to prevent injury and the misery occasioned by it) to forgive personal injuries †, or not to return evil for evil. This duty is one of the noble refinements which christianity has made upon the general maxims and practice of mankind, and enforced, with a peculiar strength and beauty, by sanctions no less alluring than aweful. And indeed the practice of it is generally its own reward; by expelling from the mind the most dreadful intruders upon its repose, those ran-

* See book I. sect. II. and IV.

† See Butler's excellent sermon (9th) on this subject.

corous

corous passions which are begot and nursed by resentment, and, by disarming, and even subduing, every enemy one has, except such as have nothing left of men but the outward form.

Hospitality. The most enlarged and humane connection of the private kind seems to be the hospitable alliance, from which flow the amiable and disinterested duties we owe to strangers. If the exercise of passions of the most private and instinctive kind is beheld with moral approbation and delight, how lovely and venerable must those appear which result from a calm philanthropy, are founded in the common rights and connections of society, and embrace men, not of a particular sect, party, or nation, but all in general without distinction, and without any of the little partialities of self-love.

CHAP. VI.

Social Duties of the Commercial Kind.

Commercial duties. THE next order of connections are those which arise from the wants and weakness of mankind, and from the various circumstances in which their different situations place them. These we may call commercial connections, and the duties which result from them commercial duties, as justice, fair-dealing, sincerity, fidelity to compacts, and the like.

Their foundation. It is observed somewhere, by a writer* of the first rank, that though nature is perfect in all her works, yet she has observed a manifest and eminent distinction among them. To all such as lie beyond the reach of human skill and power, and are properly of

* Lord Bacon.

her

her own department, she has given the finishing hand. These man may design after and imitate, but he can never rival them, nor add to their beauty or perfection. Such are the forms and structure of vegetables, animals, and many of their productions, as the honey-comb, the spider's web, and the like. There are others of her works which she has of design left unfinished, as it were, in order to exercise the ingenuity and power of man. She has presented to him a rich profusion of materials of every kind for his conveniency and use; but they are rude and unpolished, or not to be come at without art and labour. These therefore he must apply, in order to adapt them to his use, and to enjoy them in perfection. Thus nature has given him an infinite variety of herbs, grain, fossils, minerals, wood, water, earth, air, and a thousand other crude materials, to supply his numerous wants. But he must sow, plant, dig, refine, polish, build, and, in short, manufacture the various produce of nature, in order to obtain even the necessaries, and much more the conveniences and elegancies of life. These then are the price of his labour and industry, and, without that, nature will sell him nothing. But as the wants of mankind are many, and the single strength of individuals small, they could hardly find the necessaries, and much less the conveniences of life, without uniting their ingenuity and strength in acquiring these, and without a mutual intercourse of good offices. Some men are better formed for some kinds of ingenuity and labour, and others for other kinds; and different soils and climates are enriched with different productions; so that men, by exchanging the produce of their respective labours, and of supplying the wants of one country with the superfluities of another, do, in effect, diminish the labours of each, and increase the abundance of all. This is the foundation of all commerce, or exchange of commodities and goods one with

 another;

another; in order to facilitate which, men have contrived different species of coin, or money, as a common standard by which to estimate the comparative values of their respective goods. But to render commerce sure and effectual, justice, fair-dealing, sincerity, and fidelity to compacts, are absolutely necessary.

Justice, &c. Justice, or fair-dealing, or, in other words, a disposition to treat others as we would be treated by them, is a virtue of the first importance, and inseparable from the virtuous character. It is the cement of society, or that pervading spirit which connects its members, inspires its various relations, and maintains the order and subordination of each part to the whole. Without it, society would become a den of thieves and banditti, hating and hated, devouring and devoured, by one another.

Sincerity. Sincerity, or veracity, in our words and actions, is another virtue or duty of great importance to society, being one of the great bands of mutual intercourse, and the foundation of mutual trust. Without it, society would be the dominion of mistrust, jealousy, and fraud, and conversation a traffic of lies and dissimulation. It includes in it a conformity of our words with our sentiments, a correspodence between our actions and dispositions, a strict regard to truth, and an irreconcileable abhorrence of falsehood. It does not indeed require, that we expose our sentiments indiscreetly, or tell all the truth in every case; but certainly it does not and cannot admit the least violation of truth, or contradiction to our sentiments. For if these bounds are once passed, no possible limit can be assigned where the violation shall stop; and no pretence of private or public good can possibly counterbalance the ill consequences of such a violation. And we trust, the order of nature and Providence is such, that it seldom or never falls out, that so valuable a sacrifice must

must be made in order to obtain the ends of an extensive benevolence. It belongs to us to do what appears right and conformable to the laws of our nature, and to leave heaven to direct and overrule events or consequences, which it will never fail to do, for the best.

Fidelity to promises, compacts, &c.

Fidelity to promises, compacts, and engagements, is likewise a duty of such importance to the security of commerce and interchange of benevolence among mankind, that society would soon grow intolerable without the strict observance of it. Hobbes, and others who follow the same track, have taken a wonderful deal of pains to puzzle this subject, and to make all the virtues of this sort merely artificial, and not at all obligatory, antecedent to human conventions. No doubt, compacts suppose people who make them; and promises, persons to whom they are made; and therefore both suppose some society, more or less, between those who enter into these mutual engagements. But is not a compact or promise binding, till men have agreed that they shall be binding? or are they only binding because it is our interest to be bound by them, or to fulfil them? Do not we highly approve the man who fulfils them, even though they should prove to be against his interest? and do not we condemn him as a knave who violates them on that account? A promise is a voluntary declaration, by words, or by an action equally significant, of our resolution to do something in behalf of another, or for his service. When it is made, the person who makes it is by all supposed under an obligation to perform it. And he to whom it is made may demand the performance as his right. That perception of obligation is a simple idea, and is on the same footing as our other moral perceptions, which may be described by instances, but cannot be defined. Whether we have a perception of such obligation quite distinct from the interest, either public or private,

that may accompany the fulfilment of it, must be referred to the conscience of every individual. And whether the mere sense of that obligation, apart from its concomitants, is not a sufficient inducement or motive to keep one's promise, without having recourse to any selfish principle of our nature, must be likewise appealed to the conscience of every honest man. Fair-dealing and fidelity to compacts require that we take no advantage of the ignorance, passion, or incapacity of others, from whatever cause that incapacity arises;—that we be explicit and candid in making bargains, just and faithful in fulfilling our part of them. And if the other party violates his engagements, redress is to be sought from the laws, or from those who are intrusted with the execution of them. In fine, the commercial virtues and duties require that we not only do not invade, but maintain the rights of others;—that we be fair and impartial in transferring, bartering, or exchanging property, whether in goods or service; and be inviolably faithful to our word and our engagements, where the matter of them is not criminal, and were they are not extorted by force.—But on this the designed brevity of the work will not permit us further to insist.

CHAP. VII.

Social Duties of the Political Kind.

WE are now arrived at the last and highest order of duties respecting society, which result from the exercise of the most generous and heroic affections, and are founded on our most enlarged connections.

Political connections. The social principle in man is of such an expansive nature, that it cannot be confined within the circuit of a family, of friends, or a neighbourhood; it

it spreads into wider systems, and draws men into larger confederacies, communities, and commonwealths.—It is in these only that the higher powers of our nature attain the highest improvement and perfection of which they are capable. These principles hardly find objects in the solitary state of nature. There the principle of action rises no higher at farthest than natural affection towards one's offspring. There personal or family wants intirely engross the creature's attention and labour, and allow no leisure, or, if they did, no exercise for views and affections of a more enlarged kind. In solitude all are employed in the same way, in providing for the animal life. And even after their utmost labour and care, single and unaided by the industry of others, they find but a sorry supply of their wants, and a feeble, precarious security against dangers from wild beasts; from inclement skies and seasons; from the mistakes or petulant passions of their fellow-creatures; from their preference of themselves to their neighbours; and from all the little exorbitances of self-love. But in society, the mutual aids which men give and receive shorten the labours of each, and the combined strength and reason of individuals give security and protection to the whole body. There is both a variety and subordination of genius among mankind. Some are formed to lead and direct others, to contrive plans of happiness for individuals, and of government for communities, to take in a public interest, invent laws and arts, and superintend their execution, and, in short, to refine and civilize human life. Others, who have not such good heads, may have as honest hearts, a truly public spirit, love of liberty, hatred of corruption and tyranny, a generous submisssion to laws, order, and public institutions, and an extensive philanthropy. And others, who have none of those capacities either of heart or head, may be well formed for manual exercises and bodily labour. The

former

former of these principles have no scope in solitude, where a man's thoughts and concerns do all either center in himself or extend no farther than a family; into which little circle all the duty and virtue of the solitary mortal is crowded. But society finds proper objects and exercises for every genius, and the noblest objects and exercises for the noblest geniuses, and for the highest principles in the human constitution; particularly for that warmest and most divine passion which God hath kindled in our bosoms, the inclination of doing good, and reverencing our nature; which may find here both employment, and the most exquisite satisfaction. In society, a man has not only more leisure, but better opportunities, of applying his talents with much greater perfection and success, especially as he is furnished with the joint advice and assistance of his fellow-creatures, who are now more closely united one with the other, and sustain a common relation to the same moral system or community. This then is an object proportioned to his most enlarged social affections, and, in serving it he finds scope for the exercise and refinement of his highest intellectual and moral powers. Therefore, society, or a state of civil government, rests on these two principal pillars, "That in it we find security against those evils which are unavoidble in solitude—and obtain those goods, some of which cannot be obtained at all, and others not so well, in that state where men depend solely on their individual sagacity and industry."

From this short detail it appears, that man is a social creature, and formed for a social state; and that society, being adapted to the higher principles and destinations of his nature, must of necessity be his natural state.

Political duties.

The duties suited to that state, and resulting from those principles and destinations, or, in other words, from our social passions and social connections,

nections, or relation to a public system, are, love of our country, resignation and obedience to the laws, public spirit, love of liberty, sacrifice of life and all to the public, and the like.

Love of one's country.

Love of our country is one of the noblest passions that can warm and animate the human breast. It includes all the limited and particular affections to our parents, children, friends, neighbours, fellow-citizens, countrymen. It ought to direct and limit their more confined and partial actions within their proper and natural bounds, and never let them incroach on those sacred and first regards we owe to the great public to which we belong. Were we solitary creatures, detached from the rest of mankind, and without any capacity of comprehending a public interest, or without affections leading us to desire and pursue it, it would not be our duty to mind it, nor criminal to neglect it. But as we are parts of the public system, and are not only capable of taking in large views of its interest, but by the strongest affections connected with it, and prompted to take a share of its concerns, we are under the most sacred ties to prosecute its security and welfare with the utmost ardour, especially in times of public trial. This love of our country does not import an attachment to any particular soil, climate, or spot of earth, where perhaps we first drew our breath, though those natural ideas are often associated with the moral ones; and, like external signs or symbols, help to ascertain and bind them; but it imports an affection to that moral system or community, which is governed by the same laws and magistrates, and whose several parts are variously connected one with the other, and all united upon the bottom of a common interest. Perhaps indeed every member of the community cannot comprehend so large an object, especially

cially if it extends through large provinces, and over vast tracts of land; and still less can he form such an idea, if there is no public, *i. e.* if all are subject to the caprice and unlimited will of one man; but the preference the generality shew to their native country; the concern and longing after it which they express, when they have been long absent from it; the labours they undertake and sufferings they endure to save or serve it; and the peculiar attachment they have to their countrymen; evidently demonstrate that the passion is natural, and never fails to exert itself when it is fairly disengaged from foreign clogs, and is directed to its proper object. Wherever it prevails in its genuine vigour and extent, it swallows up all sordid and selfish regards, it conquers the love of ease, power, pleasure, and wealth; nay, when the amiable partialities of friendship, gratitude, private affection, or regards to a family, come in competition with it, it will teach us bravely to sacrifice all, in order to maintain the rights, and promote or defend the honour and happiness of our country.

Resignation and obedience to the laws, &c.

Resignation and obedience to the laws and orders of the society to which we belong, are political duties necessary to its very being and security, without which it must soon degenerate into a state of licence and anarchy. The welfare, nay, the nature of civil society requires, that there should be a subordination of orders, or diversity of ranks and conditions in it:—that certain men, or orders of men, be appointed to superintend and manage such affairs as concern the public safety and happiness;—that all have their particular provinces assigned them;—that such a subordination be settled among them as none of them may interfere with another; and finally, that certain rules or common measures of action be agreed on, by which each is to discharge his

his respective duty to govern or be governed, and all may concur in securing the order, and promoting the felicity, of the whole political body, those rules of action are the laws of the community, and those different orders are the several officers or magistrates appointed by the public to explain them, and superintend or assist in their execution. In consequence of this settlement of things, it is the duty of each individual to obey the laws enacted; to submit to the executors of them with all due deference and homage, according to their respective ranks and dignity, as to the keepers of the public peace, and the guardians of public liberty; to maintain his own rank, and perform the functions of his own station, with diligence, fidelity, and incorruption. The superiority of the higher orders, or the authority with which the state has invested them, intitle them, especially if they employ their authority well, to the obedience and submission of the lower, and to a proportionable honour and respect from all. The subordination of the lower ranks claims protection, defence, and security, from the higher. And the laws being superior to all, require the obedience and submission of all, being the last resort, beyond which there is no decision or appeal.—Besides these natural and stated subordinations in society, there are other accidental and artificial, the opulent and indigent, the great and the vulgar, the ingenious and prudent, and those who are less so. The opulent are to administer to the necessities of the indigent, and the indigent to return the fruits of their labours to the opulent. The great ought to defend and patronize their dependents and inferiors, and they, in their turn, to return their combined strength and assistance to the great. The prudent should improve the ingenuities of the mind for the benefit of the industrious, and the industrious lend the dexterities of their strength for the advantage of the prudent.

 Public

Foundation of public spirit, love of liberty, &c.

Public spirit, heroic zeal, love of liberty, and the other political duties, do, above all others, recommend those who practise them to the admiration and homage of mankind; because as they are the offspring of the noblest minds, so are they the parents of the greatest blessings to society. Yet, exalted as they are, it is only in equal and free governments where they can be exercised and have their due effect. For there only does a true public spirit prevail, and there only is the public good made the standard of the civil constitution. As the end of society is the common interest and welfare of the people associated, this end must of necessity be the supreme law or common standard by which the particular rules of action of the several members of the society towards each other are to be regulated. But a common interest can be no other than that which is the result of the common reason or common feelings of all. Private men, or a particular order of men, have interests and feelings peculiar to themselves, and of which they may be good judges; but these may be separate from, and often contrary to, the interests and feelings of the rest of the society; and therefore they can have no right to make, and much less to impose, laws on their fellow citizens, inconsistent with and opposite to, those interests and those feelings. Therefore, a society, government, or real public, truly worthy the name, and not a confederacy of banditti, a clan of lawless savages, or a band of slaves under the whip of a master, must be such a one as consists of freemen, chusing or consenting to laws themselves; or, since it often happens that they cannot assemble and act in a collective body, delegating a sufficient number of representatives, *i. e.* such a number as shall most fully comprehend, and most equally represent, their common feelings and common interests, to digest and vote laws for the conduct

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and controul of the whole body, the most agreeable to those common feelings and common interests.

Political duties of every citizen.

A society thus constituted by common reason, and formed on the plan of a common interest, becomes immediately an object of public attention, public veneration, public obedience, a public and inviolable attachment, which ought neither to be seduced by bribes, nor awed by terrors; an object, in fine, of all those extensive and important duties which arise from so glorious a confederacy. To watch over such a system; to contribute all he can to promote its good by his reason, his ingenuity, his strength, and every other ability, whether natural or acquired; to resist, and, to the utmost of his power, defeat every incroachment upon it, whether carried on by secret corruption, or open violence; and to sacrifice his ease, his wealth, his power, nay, life itself, and, what is dearer still, his family and friends, to defend or save it, is the duty, the honour, the interest, and the happiness of every citizen; it will make him venerable and beloved while he lives, be lamented and honoured if he falls in so glorious a cause, and transmit his name with immortal renown to the latest posterity.

Of the people.

As the people are the fountain of power and authority, the original seat of majesty, the authors of laws, and the creators of officers to execute them; if they shall find the power they have conferred abused by their trustees, their majesty violated by tyranny or by usurpation, their authority prostituted to support violence or screen corruption, the laws grown pernicious through accidents unforeseen or unavoidable, or rendered ineffectual through the infidelity and corruption of the executors of them; then it is their right, and what is their right is their duty, to resume that delegated power, and call their trustees to an account; to resist

the usurpation, and extirpate the tyranny; to restore their sullied majesty and prostituted authority; to suspend, alter, or abrogate those laws, and punish their unfaithful and corrupt officers. Nor is it the duty only of the united body; but every member of it ought, according to his respective rank, power, and weight in the community, to concur in advancing and supporting those glorious designs.

Of Britons. The obligations of every Briton to fulfil the political duties, receive a vast accession of strength when he calls to mind of what a noble and well-balanced constitution of government he has the honour to partake; a constitution founded on common reason, common consent, and common good; a constitution of free and equal laws, secured against arbitrary will and popular license, by an admirable temperament of the governing powers, controuling and controuled by one another. How must every one who has tolerable understanding to observe, or tolerable honesty to acknowledge its happy effects, venerate and love a constitution, in which the majesty of the people is, and has been frequently, recognised; in which kings are made and unmade by the choice of the people; laws enacted or annulled only by their own consent, and for their own good; in which none can be deprived of their property, abridged of their freedom, or forfeit their lives, without an appeal to the laws, and the verdict of their peers or equals; a constitution, in fine, the nurse of heroes, the parent of liberty, the patron of learning and arts, the dominion of laws, " the pride of Britain, the envy of her neighbours," and their sanctuary too!—How dissolute and execrable must their character and conduct be, who, instead of sacrificing their interest and ambition, will not part with the least degree of either to preserve inviolate, and entail in full vigour to their posterity, such a glorious constitution,

constitution, the labour of so many ages, and price of so much blood and treasure; but would chuse rather to sacrifice it, and all their own independency, freedom, and dignity, to personal power and hollow grandeur, to any little pageant of a king who should prefer being the master of slaves to being the guardian of freemen, and consider himself as the proprietor, not the father of his people!—But words cannot express the selfishness and servility of those men; and as little the public and heroic spirit of such, if any such there are, as have virtue enough still left to stem the torrent of corruption, and guard our sacred constitution against the profligacy and prostitution of the corruptors and the corrupted.

SECTION IV.

Duty to God.

Divine connections.

OF all the relations which the human mind sustains, that which subsists between the Creator and his creatures, the Supreme Lawgiver and his subjects, is the highest and the best. This relation arises from the nature of a creature in general, and the constitution of the human mind in particular; the noblest powers and affections of which point to an universal mind, and would be imperfect and abortive without such a direction. How lame then must that system of morals be, which leaves a Deity out of the question! How disconsolate, and how destitute of its firmest support!

Existence of God.

It does not appear, from any true history, or experience of the mind's progress, that any man, by any formal deduction of his discursive power, ever reasoned himself into the belief of a God. Whether such a belief is only some natural anticipation of soul, or

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is derived from father to son, and from one man to another, in the way of tradition, or is suggested to us in consequence of an immutable law of our nature, on beholding the august aspect and beautiful order of the universe, we will not pretend to determine. What seems most agreeable to experience is, that a sense of its beauty and grandeur, and the admirable fitness of one thing to another in its vast apparatus, leads the mind necessarily and unavoidably to a perception of design, or of a designing cause, the origin of all, by a progress as simple and natural as that by which a beautiful picture, or a fine building suggests to us the idea of an excellent artist. For it seems to hold universally true, that wherever we discern a tendency, or co-operation of things towards a certain end, or producing a common effect, there, by a necessary law of association, we apprehend design, a designing energy or cause. No matter whether the objects are natural or artificial, still that suggestion is unavoidable, and the connection between the effect and its adequate cause obtrudes itself on the mind, and it requires no nice search or elaborate deduction of reason to trace or prove that connection. We are particularly satisfied of its truth in the subject before us by a kind of direct intuition, and we do not seem to attend to the maxim we learn in schools, "That there cannot be an infinite series of causes and effects producing and produced by one another." Nor do we feel a great accession of light and conviction after we have learned it. We are conscious of our existence, of thought, sentiment, and passion, and sensible withal that these came not of ourselves; therefore we immediately recognise a parent mind, an original intelligence, from whom we borrowed those little portions of thought and activity. And while we not only feel kind affections in ourselves, and discover them in others, but likewise behold round us such a number and variety of creatures,

creatures, endued with natures nicely adjusted to their several stations and œconomies, supporting and supported by each other, and all sustained by a common order of things, and sharing different degrees of happiness according to their respective capacities, we are naturally and necessarily led up to the father of such a numerous offspring, the fountain of such wide-spread happiness. As we conceive this Being before all, above all, and greater than all, we naturally, and without reasoning, ascribe to him every kind of perfection, wisdom, power, and goodness without bounds, existing through all time, and pervading all space. We apply to him those glorious epithets of our Creator, Preserver, Benefactor, the Supreme Lord and Law-giver of the whole society of rational and intelligent creatures.—Not only the imperfections and wants of our being and condition, but some of the noblest instincts and affections of our minds, connect us with this great and universal nature. The mind, in its progress from object to object, from one character and prospect of beauty to another, finds some blemish or deficiency in each, and soon exhausts, or grows weary and dissatisfied with its subject; it sees no character of excellency among men equal to that pitch of esteem which it is capable of exerting; no object within the compass of human things adequate to the strength of its affection. Nor can it stay any where in this self-expansive progress, or find repose after its highest flights, till it arrives at a being of unbounded greatness and worth, on whom it may employ its sublimest powers without exhausting the subject, and give scope to the utmost force and fulness of its love without satiety or disgust. So that the nature of this being corresponds to the nature of man; nor can his intelligent and moral powers obtain their entire end, but on the supposition of such a being, and without a real sympathy and communication with

His relation to the human mind.

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him. The native propensity of the mind to reverence whatever is great and wonderful in nature, finds a proper object of homage in him who spread out the heavens and the earth, and who sustains and governs the whole of things. The admiration of beauty, the love of order, and the complacency we feel in goodness, must rise to the highest pitch, and attain the full vigour and joy of their operations, when they unite in him who is the sum and source of all perfection.

Immorality of impiety.

It is evident from the slightest survey of morals, that how punctual soever one may be in performing the duties which result from our relations to mankind, yet to be quite deficient in performing those which arise from our relation to the Almighty, must argue a strange perversion of reason or depravity of heart. If imperfect degrees of worth attract our veneration, and if the want of it would imply an insensibility, or, which is worse, an aversion to merit, what lameness of affection or immorality of character must it be to be unaffected with, and much more to be ill-affected to, a Being of superlative worth! To love society, or particular members of it, and yet to have no sense of our conneetion with its head, no affection to our Common Parent and Benefactor; to be coneerned about the approbation or censure of our fellow-creatures, and yet to feel nothing of this kind towards him who sees and weighs our aetions with unerring wisdom and justice, and can fully reward or punish them, betrays equal madness and partiality of mind. It is plain therefore beyond all doubt, that some regards are due to the great Father of all, in whom every lovely and adorable quality combines to inspire veneration and homage.

Right opinions of God.

As it has been observed already, that our affections depend on our opinions of their objeets, and generally keep pace with them, it must be of the highest importanee, and seems to be among the first

duties.

duties we owe to the author of our being, "to form the least imperfect, since we cannot form perfect, conceptions of his character and administration." For such conceptions, thoroughly imbibed, will render our religion rational, and our dispositions refined. If our opinions are diminutive and distorted, our religion will be superstitious, and our temper abject. Thus, if we ascribe to the Deity that false majesty which consists in the unbenevolent and sullen exercise of mere will or power, or suppose him to delight in the prostrations of servile fear, or as servile praise, he will be worshipped with mean adulation, and a profusion of compliments. Farther, if he be looked upon as a stern and implacable being, delighting in vengeance, he will be adored with pompous offerings, sacrifices, or whatever else may be thought proper to soothe and mollify him. But if we believe perfect goodness to be the character of the Supreme Being, and that he loves those most who resemble him most, the worship paid him will be rational and sublime, and his worshippers will seek to please him by imitating that goodness which they adore. The foundation then of all true religion is a rational faith. And of a rational faith these seem to be the chief articles; to believe, "that an infinite all-perfect mind exists, who has no opposite nor any separate interest from that of his creatures——that he superintends and governs all creatures and things——that his goodness, extends to all his creatures, in different degrees indeed, according to their respective natures, but without any partiality or envy——that he does every thing for the best, or in a subserviency to the perfection and happiness of the whole ——particularly, that he directs and governs the affairs of men ——inspects their actions,——distinguishes the good from the bad——loves and befriends the former,——is displeased with and pities the latter in this world,——and

Rational faith.

will, according to their respective deserts, reward one and punish the other in the next,——that, in fine, he is always carrying on a scheme of virtue and happiness through an unlimited duration——and is ever guiding the universe, through its successive stages and periods, to higher degrees of perfection and felicity." This is true theism, the glorious scheme of divine faith; a scheme exhibited in all the works of God, and executed through his whole administration.

Morality of theism.

This faith, well-founded and deeply felt, is nearly connected with a true moral taste, and hath a powerful efficacy on the temper and manners of the theist. He who admires goodness in others, and delights in the practice of it, must be conscious of a reigning order within, a rectitude and candour of heart, which disposes him to entertain favourable apprehensions of men, and, from an impartial survey of things, to presume that good order and good meaning prevail in the universe; and if good meaning and good order, then an ordering, an intending mind, who is no enemy, no tyrant to his creatures, but a friend, a benefactor, an indulgent sovereign.—On the other hand, a bad man, having nothing goodly or generous to contemplate within, no right intentions, nor honesty of heart, suspects every person and every thing, and, beholding nature through the gloom of a selfish and guilty mind, is either averse to the belief of a reigning order, or, if he cannot suppress the unconquerable anticipations of a governing mind, he is prone to tarnish the beauty of nature, and to impute malevolence, or blindness and impotence at least, to the sovereign ruler. He turns the universe into a forlorn and horrid waste, and transfers his own character to the Deity, by ascribing to him that uncommunicative grandeur, that arbitrary or revengeful spirit, which he affects or admires in himself. As such a temper of mind naturally

Immorality of atheism.

naturally leads to atheism, or to a superstition full as bad; therefore, as far as that temper depends on the unhappy creature in whom it prevails, the propensity to atheism or superstition consequent thereto must be immoral. Farther, if it be true that the belief or sense of a deity is natural to the mind, and the evidence of his existence reflected from his works so full as to strike even the most superficial observer with conviction, then the supplanting or corrupting that sense, or the want of due attention to that evidence, and, in consequence of both, a supine ignorance or affected unbelief of a deity, must argue a bad temper, or an immoral turn of mind. In the case of invincible ignorance, or a very bad education, though nothing can be concluded directly against the character; yet whenever ill passions and habits pervert the judgment, and by perverting the judgment terminate in atheism, then the case becomes plainly criminal.

The connection of theism and virtue.

But let casuists determine this as they will, a true faith in the divine character and administration is generally the consequence of a virtuous state of mind. The man who is truly and habitually good feels the love of order, of beauty, and goodness, in the strongest degree, and therefore cannot be insensible to those emanations of them which appear in all the works of God, nor help loving their supreme source and model. He cannot but think, that he who has poured such beauty and goodness over all his works must himself delight in beauty and goodness, and what he delights in must be both amiable and happy. Some indeed there are, and it is pity there should be any such, who, through the unhappy influence of a wrong education, have entertained dark and unfriendly thoughts of a Deity and his administration, though otherwise of a virtuous temper themselves. However, it must be acknowledged, that such sentiments have, for the most part, a bad effect on the temper; and when

they have not, it is because the undepraved affections of an honest heart are more powerful in their operation than the speculative opinions of an ill-informed head.

Duties of gratitude, love, &c.

But wherever right conceptions of the Deity and his providence prevail, when he is considered as the inexhausted source of light and love, and joy, as acting in the joint character of a father and governor, imparting an endless variety of capacities to his creatures, and supplying them with every thing necessary to their full completion and happiness, what veneration and gratitude must such conceptions, thoroughly believed, excite in the mind? How natural and delightful must it be to one whose heart is open to the perception of truth, and of every thing fair, great, and wonderful in nature, to contemplate and adore him who is the first fair, the first great, and first wonderful; in whom wisdom, power, and goodness dwell vitally, essentially, originally, and act in perfect concert? What grandeur is here to fill the most enlarged capacity, what beauty to engage the most ardent love, what a mass of wonders in such exuberance of perfection to astonish and delight the human mind through an unfailing duration!

Other affections.

If the Deity is considered as our supreme guardian and benefactor, as the father of mercies, who loves his creatures with infinite tenderness, and in a particular manner all good men, nay, all who delight in goodness even in its most imperfect degrees; what resignation, what dependence, what generous confidence, what hope in God and his all-wise providence, must arise in the soul that is possessed of such amiable views of him! All those exercises of piety, and above all a superlative esteem and love, are directed to God as to their natural, their ultimate, and indeed their only adequate object; and though the immense obligations we have received from him may excite in us more lively feelings

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of divine goodness than a general and abstracted contemplation of it, yet the affections of gratitude, and love, are of themselves of the generous disinterested kind, not the result of self-interest, or views of reward*. A perfect character, in which we always suppose infinite goodness, guided by unerring wisdom, and supported by almighty power, is the proper object of perfect love; and though that character sustains to us the relation of a benefactor, yet the mind deeply struck with that perfection, is quite lost amidst such a blaze of beauty, and grows as it were insensible to those minuter irradiations of it upon itself. To talk therefore of a mercenary love of God, or which has fear for its principal ingredient, is equally impious and absurd. If we do not love the loveliest object in the universe for his own sake, no prospect of good or fear of ill can ever bribe our esteem, or captivate our love. These affections are too noble to be bought or sold, or bartered in the way of gain; worth, or merit, is their object, and their reward is something similar in kind. Whoever indulges such sentiments and affections towards the Deity must be confirmed in the love of virtue, in a desire to imitate its all-perfect pattern, and in a cheerful security that all his great concerns, those of his friends, and of the universe, shall be absolutely safe under the conduct of unerring wisdom and unbounded goodness. It is in his care and providence alone that the good man, who is anxious for the happiness of all, finds perfect serenity, a serenity neither ruffled by partial ill, nor soured by private disappointment.

Repentance, &c.

When we consider the unstained purity and absolute perfection of the divine nature, and reflect withal on the imperfection and various blemishes of our own, we must sink, or be convinced we ought to

* See Butler's Sermon on the Love of God.

sink,

sink, into the deepest humility and prostration of soul before him, who is so wonderfully great and holy. When further, we call to mind what low and languid feelings we have of the divine presence and majesty, what insensibility of his fatherly and universal goodness, nay, what ungrateful returns we have made to it, how far we come short of the perfection of his law, and the dignity of our own nature, how much we have indulged to the selfish passions and how little to the benevolent ones; we must be conscious that it is our duty to repent of a temper and conduct so unworthy our nature, and unbecoming our obligations to its author, and to resolve and endeavour to act a wiser and better part for the future. The connection of our depravity and folly with inward remorse, and many outward calamities, being established by the Deity himself, is a natural intimation of his present displeasure with us; and a propensity to continue in the same course, contracted in consequence of the laws of habit, gives us just ground of fear, that we are obnoxious to his farther displeasure, as that propensity gives a stability to our vice and folly, and forbodes our perseverance in them.

Hopes of pardon. Nevertheless, from the character which his works exhibit of him, from those delays or alleviations of punishment which offenders often experience, and from the merciful tenor of his administration in many other instances, the sincere penitent may entertain good hopes that his parent and judge will not be strict to mark iniquity, but will be propitious and favourable to him, if he honestly endeavours to avoid his former practices, and subdue his former habits, and to live in a greater conformity to the divine will for the future. If any doubts or fears should still remain, how far it may be consistent with the rectitude and equity of the divine government to let his iniquities pass unpunished, yet he cannot

cannot think it unsuitable to his paternal clemency and wisdom to contrive a method of retrieving the penitent offender, that shall unite and reconcile the majesty and mercy of his government. If reason cannot of itself suggest such a scheme, it gives at least some ground to expect it. But though natural religion cannot let in more light and assurance on so interesting a subject, yet it will teach the humble theist to wait with great submission for any farther intimations it may please the Supreme Governor to give of his will; to examine with candour and impartiality whatever evidence shall be proposed to him of a divine revelation, whether that evidence is natural or supernatural; to embrace it with veneration and chearfulness, if the evidence is clear and convincing; and finally, if it bring to light any new relations or connections, natural religion will persuade its sincere votary faithfully to comply with the obligations, and perform the duties which result from those relations and connections. This is theism, piety, the completion of morality.

Worship, praise, thanks-giving.

We must farther observe, that all those affections which we supposed to regard the Deity as their immediate and primary object, are vital energies of the soul, and consequently exert themselves into act, and, like all other energies gain strength or greater activity by that exertion. It is therefore our duty as well as highest interest, often at stated times, and by decent and solemn acts, to contemplate and adore the great original of our existence, the parent of all beauty, and of all good; to express our veneration and love by an awful and devout recognition of his perfections, and to evidence our gratitude by celebrating his goodness, and thankfully acknowledging all his benefits. It is likewise our duty by proper exercises of sorrow and humiliation, to confess our ingratitude and folly; to signify our dependence on God, and our confidence in his goodness, by

imploring

imploring his blessing and gracious concurrence in assisting the weakness, and curing the corruptions of our nature; and finally, to testify our sense of his authority, and our faith in his government, by devoting ourselves to do his will, and resigning ourselves to his disposal. These duties are not therefore obligatory because the Deity needs, or can be profited by them; but as they are apparently decent and moral; suitable to the relations he sustains of our creator, benefactor, law-giver, and judge; expressive of our state and obligations; and improving to our tempers, by making us more rational, social, godlike, and consequently more happy.

External worship. We have now considered internal piety, or the worship of the mind, that which is in spirit and in truth; we shall conclude the section with a short account of that which is external. External worship is founded on the same principles as internal, and of a strict moral obligation. It is either private or public. Devotion that is inward, or purely intellectual, is too spiritual and abstracted an operation for the bulk of mankind. The operations of their minds, such especially as are employed on the most sublime, immaterial objects, must be assisted by their outward organs, or by some help from the imagination; otherwise they will soon be dissipated by sensible impressions, or grow tiresome if too long continued. Ideas are such fleeting things, that they must be fixed; and so subtle, that they must be expressed and delineated, as it were, by sensible marks and images; otherwise we cannot attend to them, nor be much affected by them. Therefore verbal adoration, prayer, praise, thanksgiving, and confession, are admirable aids to inward devotion, fix our attention, compose and enliven our thoughts, impress us more deeply with a sense of the awful presence in which we are, and, by a natural and mechanical sort of influence, tend to heighten those de-

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vout feelings and affections which we ought to entertain, and after this manner reduce into formal and explicit act.

Public worship.

This holds true in an higher degree in the case of public worship, where the presence of our fellow-creatures, and the powerful contagion of the social affections, conspire to kindle and spread the devout flame with greater warmth and energy. To conclude: as God is the parent and head of the social system, as he has formed us for a social state, as by one we find the best security against the ills of life, and in the other enjoy its greatest comforts, and as, by means of both, our nature attains its highest improvement and perfection; and moreover, as there are public blessings and crimes in which we all share in some degree, and public wants and dangers to which all are exposed, it is therefore evident, that the various and solemn offices of public religion are duties of indispensable moral obligation, among the best cements of society, the firmest prop of government, and the fairest ornament of both.

BOOK III. SECTION I.

Of Practical Ethics, or the Culture of the Mind.

Dignity and importance of the subject.

WE have now gone through a particular detail of the several duties we owe to ourselves, to society, and to God. In considering the first order of duties, we just touched on the methods of acquiring the different kinds of goods which we are led by nature to pursue; only we left the consideration of the method of acquiring the moral goods of the mind to a section by itself, because of its singular importance. This section then will contain a brief enumeration of the arts of

acquiring virtuous habits, and of eradicating vicious ones, as far as is consistent with the brevity of such a work; a subject of the utmost difficulty as well as importance in morals; to which, nevertheless, the least attention has been generally given by moral writers. This will properly follow a detail of duty, as it will direct us to such means or helps as are most necessary and conducive to the practice of it.

Sensible ideas and sensible taste.

In the first part of this inquiry we traced the order in which the passions shoot up in the different periods of human life. That order is not accidental, or dependant on the caprice of men, or the influence of custom and education; but arises from the original constitution and laws of our nature; of which this is one, viz. "That sensible objects make the first and strongest impressions on the mind." These, by means of our outward organs, being conveyed to the mind, become objects of its attention, on which it reflects when the outward objects are no longer present, or, in other words, when the impressions upon the outward organs cease. These objects of the mind's reflection are called ideas or images. Towards these, by another law of our nature, we are not altogether indifferent; but correspondent movements of desire or aversion, love or hatred arise, according as the objects, of which they are images or copies, made an agreeable or disagreeable impression on our organs. Those ideas and affections which we experience in the first period of life, we refer to the body, or to sense; and the taste which is formed towards them, we call a sensible, or a merely natural taste; and the objects corresponding to them we in general call good or pleasant.

Ideas of beauty and a fine taste.

But as the mind moves forward in its course, its extends its views, and receives a new and more complex set of ideas, in which it observes uniformity, variety, similitude, symmetry of parts, reference to an end,

end, novelty, grandeur. These compose a vast train and diversity of imagery, which the mind compounds, divides, and moulds into a thousand forms, in the absence of those objects which first introduced it. And this more complicated imagery suggests a new train of desires and affections, full as sprightly and engaging as any which have yet appeared. This whole class of perceptions or impressions is referred to the imagination, and forms an higher taste than the sensible, and which has an immediate and mighty influence on the finer passions of our nature, and is commonly termed a fine taste.

The objects which correspond to this taste we use to call beautiful, harmonious, great, or wonderful, or, in general, by the name of beauty.

Moral ideas and a moral taste.

The mind, still pushing onwards and increasing its stock of ideas, ascends from those to an higher species of objects, viz. the order and mutual relations of minds to each other, their reciprocal affections, characters, actions, and various aspects. In these it discovers a beauty, a grandeur, a decorum, more interesting and alluring than in any of the former kinds. These objects, or the images of them passing in review before the mind, do, by a necessary law of our nature, call forth another and nobler set of affections, as admiration, esteem, love, honour, gratitude, benevolence, and others of the like tribe. This class of perceptions, and their correspondent affections, we refer, because of their objects (manners), to a moral sense, and call the taste or temper they excite, moral. And the objects which are agreeable to this taste or temper we denominate by the general name of moral beauty, in order to distinguish it from the other which is termed natural.

Sources of association.

These different sets of ideas or images are the materials about which the mind employs itself, which it blends, ranges and diversifies ten thou-

sand different ways. It feels a strong propension to connect and associate those ideas among which it observes any similitude or any aptitude, whether original and natural or customary and artificial, to suggest each other. Thus it is ready to associate the ideas of natural and moral beauty, as both partake of the same principle, viz. design, harmony of parts, or reference to an end, and are relative to mind, the common origin of both. A fine face, or a graceful deportment, naturally suggest ideas of moral beauty. And many outward badges, as crowns, crosiers, purple robes, and statues, do often, by the force of custom, excite moral sentiments, as majesty, piety, justice, virtue. If any particular sets of ideas have been found at any time to co-exist in the same objects, the mind shall ever after have a propensity to unite them, even when they no longer co-exist. Thus, because we have sometimes seen a good temper accompanying a good aspect, virtue annexed to politeness, merit to fame, we are strongly inclined to fancy that they can never be disunited. When any ideas or sets of ideas have been produced by certain objects or occasions immediately and presently, which objects or occasions have afterwards given rise to a different and perhaps quite opposite set of ideas or impressions, the same objects recurring, shall bring in view the former set, while the latter being posterior in time, shall be entirely forgot. Thus the drinker or rake, upon seeing his bottle, and his companion, or mistress, shall amuse himself with all the gay ideas of agreeable fellowship, friendship, gentleman-like enjoyment, giving and receiving pleasures, which those objects first excited; but, by an unhappy self-delusion, shall overlook those head-aches, heart-aches, that satiety, and those other mortifying impressions which accompanied, though more latterly, his intemperate indulgencies.

But

Laws of association.

But whatever the reasons are, whether similitude, co-existence, causality, or any other aptitude or relation, why any two or more ideas are connected by the mind at first, it is an established law of our nature, "that when two or more ideas have often started in company, they form so strong an union, that it is very difficult ever after to separate them." Thus the lover cannot separate the idea of merit from his mistress; the courtier that of dignity from his title or ribbon; the miser that of happiness from his bags. Here the mind's process is often the same as in its more abstracted operations. When it has once been convinced of the truth of any geometrical proposition, it may strongly retain the connection of the terms of the proposition, suppose the equality of the angles of a triangle to two right ones, though it does not attend to, or has perhaps forgot, the intervening ideas which shewed that connection. In like manner, though perhaps it was the tendency of wealth or power, when well employed, to private pleasure, or public happiness, that gave the fond admirers of either the first notion of their value, yet their mind, having once settled that connection, frequently forgets the immediate link, viz. the wise or generous use, and by degrees comes to admire wealth and power for themselves, fancying them intrinsically valuable, however they are used, and whether used or not. By these and many other ways the strongest associations of ideas are formed, the different sets of ideas beforementioned are shuffled together without regularity or distinction, often without any natural alliance or relation, by mere accident, example, company, sympathy, education, and sometimes by caprice. So that any kind of natural good shall be combined with moral beauty, nay ideas the most opposite in nature shall be coupled together, so as hardly to be ever disunited in the observer's mind: as for instance, prudence with craft,

honour

honour with injustice, religion with inhumanity, corruption or sedition with patriotism.—It is these associations of worth or happiness with any of the different sets of objects or images before specified, that form our taste, or complex idea of good. By another law of our nature, "our affections follow and are governed by this taste. And to these affections our character and conduct are similar and proportioned, on the general tenor of which our happiness principally depends."

Leading passions follow taste.

As all our leading passions then depend on the direction which our taste takes, and as it is always of the same strain with our leading associations, it is worth while to inquire a little more particularly how these are formed, in order to detect the secret sources from whence our passions derive their principal strength, their various rises and falls. For this will give us the true key to their management, and let us into the right method of correcting the bad, and improving the good.

The importance and use of the imagination.

A very slight inspection into human nature suggests to us, that no kind of objects make so powerful an impression on us as those which are immediately impressed on our senses, or strongly painted on our imaginations. Whatever is purely intellectual, as abstracted or scientific truths, the subtile relations and differences of things, has a fainter sort of existence in the mind; and, though it may exercise and whet the memory, the judgment, or the reasoning power, gives hardly any impulse at all to the active powers, the passions, which are the main springs of motion. On the other hand, were the mind entirely under the direction of sense, and impressible only by such objects as are present, and strike some of the outward organs, we should then be precisely in the state of the brute creation, and be governed solely by instinct or appetite, and have no power to controul whatever impressions are made upon

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us: Nature has therefore endued us with a middle faculty, wonderfully adapted to our mixed state, which holds partly of sense and partly of reason, being strongly allied to the former, and the common receptacle in which all the notices that come from that quarter are treasured up; and yet greatly subservient and ministerial to the latter, by giving a body, a coherence, and beauty to its conceptions. This middle faculty is called the imagination, one of the most busy and fruitful powers of the mind. Into this common storehouse are likewise carried all those moral images or forms which are derived from our moral faculties of perception; and there they often undergo new changes and appearances, by being mixed and wrought up with the images and forms of sensible and natural things. By this coalition of imagery, natural beauty is dignified and heightened by moral qualities and perfections, and moral qualities are at once exhibited and set off by natural beauty. The sensible beauty, or good, is refined from its dross by partaking of the moral; and the moral receives a stamp, a visible character and currency, from the sensible.—But in order to judge of this mutual influence, it will be proper to give a few instances of the process of the imagination, or of the energy of the associating principle.

Its energy in various instances in heightening sensible pleasures.

As we are first of all accustomed to sensible impressions and sensible enjoyments, we contract early a sensual relish, or love of pleasure in the lower sense of the word. In order however to justify this relish, the mind, as it becomes open to higher perceptions of beauty and good, borrows from hence a nobler set of images, a fine taste, generosity, social affection, friendship, good fellowship, and the like; and, by dressing out the old pursuits with these new ornaments, gives them an additional dignity and lustre. By these ways the desire of a table, love of finery, intrigue,

trigue, and pleasure, are vastly increased beyond their natural pitch, having an impulse combined of the force of the natural appetites, and of the superadded strength of those passions which tend to the moral species.—When the mind becomes more sensible to those objects or appearances in which it perceives beauty, uniformity, grandeur, and harmony, as fine clothes, elegant furniture, plate, pictures, gardens, houses, equipage, the beauty of animals, and particularly the attractions of the sex; to these objects the mind is led by nature, or taught by custom, the opinion and example of others, to annex certain ideas of moral character, dignity, decorum, honour, liberality, tenderness, and active or social enjoyment. The consequence of this association is, that the objects to which these are annexed must rise in their value, and be pursued with proportionable ardour. The enjoyment of them is often attended with pleasure; and the mere possession of them, where that is wanting, frequently draws respect from one's fellow-creatures: this respect is, by many, thought equivalent to the pleasure of enjoyment. Hence it happens that the idea of happiness is connected with the mere possession, which is therefore eagerly sought after, without any regard to the generous use or honourable enjoyment. Thus the passion, resting on the means, not the end, *i. e.* losing sight of its natural object, becomes wild and extravagant.

In heightening the pleasures of beauty, harmony, &c.

In raising the value of external symbols, &c.

In fine, any object, or external denomination, a staff, a garter, a cup, a crown, a title, may become a moral badge or emblem of merit, magnificence, or honour, according as these have been found or thought, by the possessors or admirers of them, to accompany them; yet by the deception formerly mentioned, the merit or the conduct which intitled, or should intitle, to those marks of distinction, shall be forgot

got or neglected, and the badges themselves be passionately affected or pursued, as including every excellency. If these are attained by any means, all the concomitants which nature, custom, or accidents have joined to them, will be supposed to follow of course. Thus, moral ends with which the unhappy admirer is apt to colour over his passion and views, will, in his opinion, justify the most immoral means, as prostitution, adulation, fraud, treachery, and every species of knavery, whether more open or more disguised.

In heightening the value of wealth, power, &c.

When men are once engaged in active life, and find that wealth and power, generally called interest, are the great avenues to every kind of enjoyment, they are apt to throw in many engaging moral forms to the object of their pursuit, in order to justify their passion, and varnish over the measures they take to gratify it, as independency on the vices or passions of others, provision and security to themselves and friends, prudent œconomy or well placed charity, social communication, superiority to their enemies, who are all villains, honourable service, and many other ingredients of merit. To attain such capacities of usefulness or enjoyment, what arts, nay, what meannesses, can be thought blameable by those cool pursuers of interest?—Nor have they, whom the gay world is pleased to indulge with the title of men of pleasure, their imaginations less pregnant with moral images, with which they never fail to ennoble, or, if they cannot do that, to palliate their gross pursuits. Thus admiration of wit, of sentiments and merit, friendship, love, generous sympathy, mutual confidence, giving and receiving pleasure, are the ordinary ingredients with which they season their gallantry and pleasurable entertainments; and by which they impose on themselves, and endeavour to impose on others, that their amours are the joint issue of good sense and virtue.

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Its influence on all the passions.

These associations, variously combined and proportioned by the imagination, form the chief private passions, which govern the lives of the generality, as the love of action, of pleasure, power, wealth, and fame; they influence the defensive, and affect the public passions, and raise joy or sorrow as they are gratified or disappointed. So that in effect these associations of good and evil, beauty and deformity, and the passions they raise, are the main hinges of life and manners, and the great sources of our happiness or misery. It is evident, therefore, that the whole of moral culture must depend on giving a right direction to the leading passions, and duly proportioning them to the value of the objects or goods pursued, under what name soever they may appear.

Moral culture, by correcting our taste or imagination.

Now, in order to give them this right direction and due proportion, it appears from the foregoing detail, that those associations of ideas, upon which the passions depend, must be duly regulated; that is to say, as an exorbitant passion for wealth, pleasure, or power, flows from an association or opinion that more beauty and good, whether natural or moral, enters into the enjoyment or possession of them, than really belongs to either; therefore, in restoring those passions to their just proportion, we must begin with correcting the opinion, or breaking the false association, or, in other words, we must decompound the complex phantom of happiness or good, which we fondly admire; disunite those ideas that have no natural alliance; and separate the original idea of wealth, power, or pleasure, from the foreign mixtures incorporated with it, which enhance its value, or give it its chief power to enchant and seduce the mind. For instance, let it be considered how poor and inconsiderable a thing wealth is, if it be disjoined from real use, or from ideas of capacity

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in the possessor to do good, from independency, generosity, provision for a family or friends, and social communication with others. By this standard let its true value be fixed; let its misapplication, or unbenevolent enjoyment, be accounted sordid and infamous; and nothing worthy or estimable be ascribed to the mere possession of it, which is not borrowed from its generous use.

By self-denial and a counter process.

If that complex form of good which is called pleasure engages us, let it be analysed into its constituent principles, or those allurements it draws from the heart and imagination, in order to heighten the low part of the indulgence; let the separate and comparative moment of each be distinctly ascertained and deduced from that gross part, and this remainder of the accumulated enjoyment will dwindle down into a poor, insipid, transitory thing. In proportion as the opinion of the good pursued abates, the admiration must decay, and the passion lose strength of course. One effectual way to lower the opinion, and consequently to weaken the habit founded on it, is to practise lesser pieces of self-denial, or to abstain, to a certain pitch, from the pursuit or enjoyment of the favourite object; and, that this may be the more easily accomplished, one must avoid those occasions, that company, those places, and the other circumstances, that enflamed one and endeared the other. And, as a counter-process, let higher or even different enjoyments be brought in view, other passions played upon the former, different places frequented, other exercises tried, company kept with persons of a different or more correct way of thinking, both in natural and moral subjects.

By a sound and natural education.

As much depends on our setting out well in life, let the youthful fancy, which is apt to be

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very florid and luxuriant, be early accustomed, by instruction, example, and significant moral exercises, nay, by looks, gestures, and every other testimony of just approbation or blame, to annex ideas of merit, honour, and happiness, not to birth, dress, rank, beauty, fortune, power, popularity, and the like outward things, but to moral and truly virtuous qualities, and to those enjoyments which spring from a well-informed judgment and a regular conduct of the affections, especially those of the social and disinterested kind. Such dignified forms of beauty and good, often suggested, and, by moving pictures and examples, warmly recommended to the imagination, enforced by the authority of conscience, and demonstrated by reason to be the surest means of enjoyment, and the only independent, undepriveable, and durable goods, will be the best counterbalance to meaner passions, and the firmest foundation and security to virtue.

By rightly studying human nature.

'It is of great importance to the forming a just taste, or pure and large conceptions of happiness, to study and understand human nature well, to remember what a complicated system it is, particularly to have deeply imprinted on our mind that gradation of senses, faculties, and powers of enjoyment formerly mentioned, and the subordination of goods resulting from thence, which nature points out, and the experience of mankind confirms. Who, when they think seriously, and are not under the immediate influence of some violent prejudice or passion, prefer not the pleasures of action, contemplation, society, and most exercises and joys of the moral kind, as friendship, natural affection, and the like, to all sensual gratifications whatsoever? Where the different species of pleasure are blended into one complex form, let them be accurately distinguished, and be referred each to its proper faculty and sense, and examined

amined apart what they have peculiar, what common with others, and what foreign and adventitious. Let wealth, grandeur, luxury, love, fame, and the like, be tried by this test, and their true alloy will be found out.—Let it be farther considered, whether the mind may not be easy and enjoy itself greatly though it want many of those elegancies and superfluities of life which some possess, or that load of wealth and power which others eagerly pursue, and under which they groan. Let the difficulty of attaining, the precariousness of possessing, and the many abatements in enjoying, over-grown wealth and envied greatness, of which the weary possessors so frequently complain, as the hurry of business, the burden of company, of paying attendance to the few, and giving it to the many, the cares of keeping, the fears of losing, and the desires of increasing what they have, and the other troubles which accompany this pitiful drudgery and pompous servitude; let these and the like circumstances be often considered, that are conducive to the removing or lessening the opinion of such goods, and the attendant passion or set of passions will decay of course.

By comparing the moment and abatements of different goods.

Let the peculiar bent of our nature and character be observed, whether we are most inclined to form associations and relish objects of the sensual, intellectual, or moral kind. Let that which has the ascendant be particularly watched, let it be directed to right objects, be improved by proportioned exercises, and guarded by proper checks from an opposite quarter. Thus the sensible turn may be exalted by the intellectual, and a taste for the beauty of the fine arts, and both may be made subservient to convey and rivet sentiments highly moral and public spirited. This inward survey must extend to the strength and weaknesses of one's nature, one's condition, connections, habitudes, fortune, studies, acquaintance, and the other circumstances

By observing our own bent and character, &c.

stances of one's life, from which every man will form the justest estimate of his own dispositions and character, and the best rules for correcting and improving them. And in order to do this with more advantage, let those times or critical seasons be watched when the mind is best disposed towards a change; and let them be improved by vigorous resolutions, promises, or whatever else will engage the mind to persevere in virtue. Let the conduct, in fine, be often reviewed, and the causes of its corruption or improvement be carefully observed.

By frequent moral exercises.

It will greatly conduce to refine the moral taste, and strengthen the virtuous temper, to accustom the mind to the frequent exercise of moral sentiments and determinations, by reading history, poetry, particularly of the picturesque and dramatic kind, the study of the fine arts; by conversing with the most eminent for good sense and virtue; but, above all, by frequent and repeated acts of humanity, compassion, friendship, politeness, and hospitality. It is exercise gives health and strength. He that reasons most frequently becomes the wisest, and most enjoys the pleasures of wisdom. He who is most often affected by objects of compassion in poetry, history, or real life, will have his soul most open to pity, and its delightful pains and duties. So he also who practises most diligently the offices of kindness and charity, will by it cultivate that disposition from whence all his pretensions to personal merit must arise, his present and his future happiness.

By an honest employment.

An useful and honourable employment in life will administer a thousand opportunities of this kind, and greatly strengthen a sense of virtue and good affections which must be nourished by right training, as well as our understandings. For such an employment, by enlarging one's experience, giving an habit of attention and caution, or obliging one, from necessity

cessity or interest, to keep a guard over the passions, and study the outward decencies and appearances of virtue, will by degrees produce good habit, and at length insinuate the love of virtue and honesty for its own sake.

By viewing men and manners in a fair light.

It is a great inducement to the exercise of benevolence to view human nature in a favourable light, to observe the characters and circumstances of mankind on the fairest sides, to put the best constructions on their actions they will bear, and to consider them as the result of partial and mistaken, rather than ill affections, or, at worst, as the excesses of a pardonable self-love, seldom or never the effect of pure malice.

By consideration and pious exercises.

Above all, the nature and consequences of virtue and vice, their consequences being the law of our nature and will of heaven; the light in which they appear to our Supreme Parent and Lawgiver, and the reception they will meet with from him, must be often attended to. The exercises of piety, as adoration and praise of the divine excellency, invocation of, and dependance on his aid, confession, thanksgiving, and resignation, are habitually to be indulged, and frequently performed, not only as medicinal, but highly improving to the temper.

By just views of human life and its connection with a future.

To conclude: it will be of admirable efficacy towards eradicating bad habits, and implanting good ones, frequently to contemplate human life as the great nursery of our future and immortal existence, as that state of probation in which we are to be educated for a divine life. To remember, that our virtues or vices will be immortal as ourselves, and influence our future as well as our present happiness—and, therefore, that every disposition and action is to be regarded as pointing beyond the present to an immortal duration. An habitual attention to this wide and important

portant connection will give a vast compass and dignity to our sentiments and actions, a noble superiority to the pleasures and pains of life, and a generous ambition to make our virtue as immortal as our being.

SECTION II.

Motives to Virtue from Personal Happiness.

Motives from personal happiness.

WE have already considered our obligations to the practice of virtue, arising from the constitution of our nature, by which we are led to approve a certain order and œconomy of affections, and a certain course of action correspondent to it*.—But, besides this, there are several motives which strengthen and secure virtue, though not themselves of a moral kind. These are, its tendency to personal happiness, and the contrary tendency of vice. "Personal happiness arises either from the state of a man's own mind, or from the state and disposition of external causes towards him."

Happiness of virtue from within.

We shall first examine the "Tendency of virtue to happiness with respect to the state of a man's own mind."—This is a point of the utmost consequence in morals, because, unless we can convince ourselves, or shew to others, that, by doing our duty, or fulfilling our moral obligations, we consult the greatest satisfaction of our own mind, or our highest interest on the whole, it will raise strong and often unsurmountable prejudices against the practice of virtue, especially whenever there arises any appearances of opposition between our duty and our satisfaction or interest. To creatures so desirous of happiness, and averse to misery, as we are, and

* Vid. Book I. Sect. 1, 2, &c.

often

often so oddly situated amidst contending passions and interests, it is necessary that virtue appear not only an honourable, but a pleasing and beneficent form. And in order to justify our choice to ourselves as well as before others, we must ourselves feel and be able to avow in the face of the whole world, that her ways are ways of pleasantness, and her paths the paths of peace. This will shew, beyond all contradiction, that we not only approve, but can give a sufficient reason for what we do.

Influence of vice on the temper of the mind.

Let any man, in a cool hour, when he is disengaged from business, and undisturbed by passion (as such cool hours will sometimes happen) sit down, and seriously reflect with himself, what state or temper of mind he would chuse to feel and indulge, in order to be easy and to enjoy himself. Would he chuse, for that purpose to be in a constant dissipation and hurry of thought; to be disturbed in the exercise of his reason; to have various and often interfering phantoms of good playing before his imagination, soliciting and directing him by turns, now soothing him with amusing hopes, then torturing him with anxious fears; and to approve this minute what he shall condemn the next? Would he chuse to have a strong and painful sense of every petty injury; quick apprehensions of every impending evil; incessant and insatiable desires of power, wealth, honour, pleasure; an irreconcileable antipathy against all competitors and rivals; insolent and tyrannical dispositions to all below him; fawning, and at the same time envious, dispositions to all above him; with dark suspicions and jealousies of every mortal? Would he chuse neither to love nor be beloved of any; to have no friend in whom to confide, or with whom to interchange his sentiments or designs; no favourite, on whom to bestow his kindness, or vent his passions; in fine, to be conscious of no merit with mankind, no esteem from any creature, no good af-

fection to his Maker, no concern for, nor hopes of, his approbation; but instead of all these, to hate, and know that he is hated, to contemn, and know that he is contemned by all; by the good, because he is so unlike; and by the bad, because he is so like themselves; to hate, or to dread the very being that made him; and, in short, to have his breast the seat of pride and passion, petulance and revenge, deep melancholy, cool malignity, and all the other furies that ever possessed and tortured mankind? —Would our calm inquiry after happiness pitch on such a state, and such a temper of mind, as the most likely means to put him in possession of his desired ease and self-enjoyment.

Influence of virtue on the temper.

Or would he rather chuse a serene and easy flow of thought; a reason clear and composed; a judgment unbiassed by prejudice, and undistracted by passion; a sober and well-governed fancy, which presents the images of things true, and unmixed with delusive and unnatural charms, and therefore administers no improper or dangerous fuel to the passions, but leaves the mind free to chuse or reject, as becomes a reasonable creature; a sweet and sedate temper, not easily ruffled by hopes or fears, prone neither to suspicion nor revenge, apt to view men and things in the fairest lights, and to bend gently to the humours of others, rather than obstinately to contend with them? Would he chuse such moderation and continence of mind, as neither to be ambitious of power, fond of honours, covetous of wealth, nor a slave to pleasure; a mind of course neither elated with success, nor dejected with disappointment; such a modest and noble spirit as supports power without insolence, wears honour without pride, uses wealth without profusion or parsimony; and rejoices more in giving than in receiving pleasure; such fortitude and equanimity as rises above misfortunes, or turns them into blessings; such integrity and great-

ness

ness of mind, as neither flatters the vices nor triumphs over the follies of men; as equally spurns servitude and tyranny, and will neither engage in low designs, nor abet them in others? Would he chuse, in fine, such mildness and benignity of heart as takes part in all the joys and refuses none of the sorrows of others; stands well-affected to all mankind; is conscious of meriting the esteem of all, and of being beloved by the best; a mind which delights in doing good without any shew, and yet arrogates nothing on that account, rejoices in loving and being beloved by its Maker, acts ever under his eye, resigns itself to his providence, and triumphs in his approbation?—Which of these dispositions would be his choice, in order to be contented, serene and happy?—The former temper is vice, the latter virtue. Where one prevails, there misery prevails, and by the generality is acknowledged to prevail. Where the other reigns, there happiness reigns, and by the confession of mankind is acknowledged to reign. The perfection of either temper is misery or happiness in perfection. Therefore, every approach to either extreme, is an approach to misery, or to happiness; that is to say, every degree of vice or virtue is accompanied with a proportionable degree of misery or happiness.

An objection from an imaginary coalition of virtue and vice.

But many are of opinion, and by their practice seem to avow the opinion, that, by blending or softening the extremes, and artfully reconciling virtue with vice, they bid fairer to strike a just medium of happiness, to pass more smoothly through life, and to have more resources in the present embarrassed scene. "Honesty (they acknowledge) is, in the main, the best policy, but it is often too blunt and surly, and always too scrupulous; and therefore to temper and season it with a little discreet craft, in critical

and

and well-chosen conjunctures, will, they think, make it more palatable to others and more profitable to one's self. Kind affection is a good thing in its own place, and when it costs a man nothing; but charity begins at home; and one's regard for others must still look that way, and be subservient to the main chance. Besides, why suffer unnecessary disquiet on the account of others? Our own happiness is charge enough to us; and if we are not to be happy till others are so too, it is a mere Utopian dream ever to expect it. One would not chuse to do ill for the sake of ill; but when necessity requires it, the lesser good must submit to the greater, that is, to our own personal good; for in it by the first and fundamental law of our nature, we are most interested. By such a conduct we shall have least reason to accuse ourselves, be most easy within, and best secured against the misfortunes and assaults of others."

The temper and condition of half-honesty, or knavery.

This is the language of great partiality of thought, as well as great partiality of heart.—But as it is one of the main forts in which selfishness and knavery use to entrench themselves, it may be worth while to beat it down, to make way for the full triumph of their fair adversary. That men may neglect or hurt their own interest by an indiscreet concern about that of others—that honesty may sometimes degenerate into a blunt surliness, or a peevish scrupulosity—that important occasions may demand the sacrifice of a less public to a greater private good—that it were folly to make one's self miserable, because others are not so happy as one would wish, we do not deny. But is there not the justest reason to suspect, that the dishonest, or the half-honest and contracted turn of mind here pleaded for, is the very reverse of that temper which begets true satisfaction and self-enjoyment, and of that character which

intitles

intitles to credit, security, and success? The man who doubts and hesitates whether he may not, in some instances, play the knave, cannot, in any sense, be termed honest. And surely he cannot approve himself for that conduct, which, by an inviolable law of his nature, he is compelled to condemn; and if he cannot approve himself for his conduct, he is deprived of one of the sweetest feelings of the human heart. But suppose he could disguise the immoral deed or disposition under the fair name of some virtue, or the mask at least of a necessary self-regard, as is often done, to elude the awful decision of conscience, which when uninfluenced is always unerring; yet he must be conscious he cannot stand the test of judges less interested than himself; and must therefore be under constant dread of discovery, and consequently of public censure, with all its mortifying attendants. This dread must be so much the greater, if he has had companions or tools of his knavery, which generally it must have in order to supply its native impotence and deficiency. This then is to be insecure, obnoxious, and dependant, and that too on the worst set of men, on whom one can have no hold but by their vices, which, like undisciplined wild beasts often turn upon their masters. Such an insecure, obnoxious, dependant state, must necessarily be a state of suspicion, servitude, and fear, which, instead of begetting serenity and self-enjoyment, are the parents of disquiet and misery. Besides, the fluctuating perpetually between opposite principles, the violence done to a native sense of honesty, the reluctance against the first advances of young and blushing knavery, the hot and cold fits of alternate virtue and vice, the suspense and irresolution of a mind distracted between interfering passions, are the first painful symptoms of that dreadful disease which afterwards lays waste every

thing

thing goodly and ingenuous, and raises agonies intolerable to the patient, and quite inconceivable by others. Whether such an inconsistent conduct, divided between vice and virtue, will serve the views of interest proposed by it, will be afterwards examined.

Temper and condition of the good benevolent man.

As to the other part of the objection, let it be considered, that a man of an enlarged benevolent mind, who thinks, feels, and acts for others, is not subject to half the disquietudes of the contracted selfish soul ;—finds a thousand alleviations to soften his disappointments, which the other wants ;—and has a fair chance for double his enjoyments. —His desires are moderate, and his wants few in comparison of the other's, because they are measured by nature, which has limits ; not by fancy or passion, which has none. He is cautious, without being distrustful or jealous; careful, but not anxious; busy, but not distracted. He tastes pleasure, without being dissipated ; bears pain, without dejection or discontent ; is raised to power, without turning giddy ; feels few of the pains of competition, and none of the pains of envy.

The alleviations of his ills.

The principal alleviations of his calamities are these :—That though some of them may have been the effect of his imprudence, or weakness, yet few of them are sharpened by a sense of guilt, and none of them by a consciousness of wickedness, which surely is their keenest sting ;—that they are common to him with the best of men ;—that they seldom or never attack him unprepared, but rather guarded with a consciousness of his own sincerity and virtue, with a faith and trust in Providence, and a firm resignation to its perfect orders ; —that they may be improved as means of correction, or materials to give scope and stability to his virtues ;—and, to name no more, they are considerably lessened, and often

often sweetened, to him, by the general sympathy of the wise and good.

His enjoyments. His enjoyments are more numerous, or, if less numerous, yet more intense than those of the bad man; for he shares in the joys of others by rebound; and every increase of general or particular happiness is a real addition to his own. It is true, his friendly sympathy with others subjects him to some pains which the hard-hearted wretch does not feel; yet to give a loose to it is a kind of agreeable discharge. It is such a sorrow as he loves to indulge; a sort of pleasing anguish that sweetly melts the mind, and terminates in a self-approving joy. Though the good man may want means to execute, or be disappointed in the success of, his benevolent purposes; yet, as was formerly * observed, he is still conscious of good affection, and that consciousness is an enjoyment of a more delightful savour than the greatest triumphs of successful vice. If the ambitious, covetous, or voluptuous are disappointed, their passions recoil upon them with a fury proportioned to their opinion of the value of what they pursue, and their hope of success; while they have nothing within to balance the disappointment, unless it is a useless fund of pride, which however frequently turns mere accidents into mortifying affronts, and exalts grief into rage and phrensy. Whereas the meek, humble, and benevolent temper is its own immediate reward, is satisfied from within; and as it magnifies greatly the pleasure of success, so it wonderfully alleviates, and in a manner annihilates, all pain for the want of it.

From merited esteem and sympathy. As the good man is conscious of loving and wishing well to all mankind, he must be sensible of his deserving the esteem and good-

* See Book II. Sect. 2.

will

will of all; and this supposed reciprocation of social feelings is, by the very frame of our nature, made a source of very intense and enlivening joys. By this sympathy of affections and interests he feels himself intimately united with the human race; and, being sensibly alive over the whole system, his heart receives and becomes responsive to every touch given to any part. So that, as an eminent philosopher * finely expresses it, he gathers contentment and delight from the pleased and happy states of those around him, from accounts and relations of such happiness, from the very countenances, gestures, voices, and sounds, even of creatures foreign to our kind, whose signs of joy and contentment he can any way discern.

Do not interfere with other joys.

Nor do those generous affections stop any other natural source of joy whatever, or deaden his sense of any innocent gratification. They rather keep the several senses and powers of enjoyment open and disengaged, intense and uncorrupted by riot or abuse; as is evident to any one who considers the dissipated, unfeeling state of men of pleasure, ambition, or interest, and compares it with the serene and gentle state of a mind at peace with itself and friendly to all mankind, unruffled by any violent emotion, and sensible to every good-natured and alluring joy. He who daily dwells with temperance and virtue, those everlasting beauties and of the highest order, cannot be insensible to the charms of society or friendship, the attractions of virtuous love, the delights of reading, or to any beauty of a lower species, the unbendings of innocent mirth, or whatever else sets the soul at ease, and gives him a relish of his being. By enjoying himself, he is in the best posture for enjoying every thing else. All is pure and well-ordered in such a heart; and

* Vide Shaftsb. Inq. into Virtue, Book II.

therefore

therefore whatever pleasure is poured into it has an original savour, not a single drop is lost: for virtue draws off all but the dregs, and, by mixing something of her own with the most ordinary entertainments, refines them into exalted enjoyments.

The misery of excess in the private passions.

It were easy, by going through the different sets of affections mentioned formerly *, to shew, that it is only by maintaining the proportion settled there that the mind arrives at true repose and satisfaction. If fear exceeds that proportion, it sinks into melancholy and dejection. If anger passes just bounds, it ferments into rage and revenge, or subsides into a sullen corroding gloom, which embitters every good, and renders one exquisitely sensible to every ill. The private passions, the love of honour especially, whose impulses are more generous as its effects are more diffusive, are instruments of private pleasure; but if they are disproportioned to our wants, or to the value of their several objects, or to the balance of other passions equally necessary and more amiable, they become instruments of intense pain and misery. For, being now destitute of that counterpoise which held them at a due pitch, they grow turbulent, peevish, and revengeful, the cause of constant restlessness and torment, sometimes flying out into a wild delirious joy, at other times settling in a deep splenetic grief. The concert between reason and passion is then broke: all is dissonance and distraction within. The mind is out of frame, and feels an agony proportioned to the violence of the reigning passion.

In the publicaffections.

The case is much the same, or rather worse, when any of the particular kind affections are out of their natural order and proportion; as happens in the case of effeminate pity, exorbitant love, parental

* See Book I. Sect. 1, 2.

 dotage,

dotage, or any party passion, where the just regards to society are supplanted. The more social and disinterested the passion is, it breaks out into the wilder excesses, and makes the more dreadful havock both within and abroad; as is but too apparent in those cases where a false species of religion, honour, zeal, or party rage, has seized on the natural enthusiasm of the mind, and worked it up to madness. It breaks through all ties natural and civil, contracts the most sacred and solemn obligations, silences every other affection whether public or private, and transforms the most gentle natures into the most savage and inhuman. Such an exorbitant passion is like the enormous growth of a natural member, which not only draws from the nourishment of the rest, but threatens the mortification of the whole body, and in the mean time occasions intolerable pain and anguish. In fine, all the natural affections, like the animal spirits, or humours of a strong body, if restrained from their proper play, turn furious or melancholic, and generally force their way by some violent discharge, no less hurtful to the patient than offensive to those with whom he is connected.

Happiness of well-proportioned passions.

Whereas the man who keeps the balance of affection even is easy and serene in his motions; mild, and yet affectionate; uniform and consistent with himself; is not liable to disagreeable collisions of interests and passions; gives always place to the most friendly and humane affections, and never to dispositions or acts of resentment, but on high occasions, when the security of the private, or welfare of the public system, or the great interests of mankind, necessarily require a noble indignation; and even then he observes a just measure in wrath; and, last of all, he proportions every passion to the value of the object he affects, or to the importance of the end he pursues.

To

To sum up this part of the argument, the honest and good man has eminently the advantage of the knavish and selfish wretch in every respect. The pleasures which the last enjoys flow chiefly from external advantages and gratifications; are superficial and transitory; dashed with long intervals of satiety, and frequent returns of remorse and fear; dependent on favourable accidents and conjunctures; and subjected to the humours of men. But the good man is satisfied from himself; his principal possessions lie within, and therefore beyond the reach of the caprice of men or fortune; his enjoyments are exquisite and permanent; accompanied with no inward checks to damp them, and always with ideas of dignity and self-approbation; may be tasted at any time and in any place*. The gratifications of vice are turbulent and unnatural, generally arising from the relief of passions in themselves intolerable, and issuing in tormenting reflections; often irritated by disappointment, always inflamed by enjoyment; and yet ever cloyed with repetition. The pleasures of virtue are calm and natural; flowing from the exercise of kind affections, or delightful reflections in consequence of them; not only agreeable in the prospect, but in the present feeling; they never satiate, nor lose their relish; nay, rather the admiration of virtue grows stronger every day; and not only is the desire but the enjoyment heightened by every new gratification; and unlike to most others, it is encreased, not diminished, by sympathy and communication. In fine, the satisfactions of virtue may be purchased without a bribe, and possessed in the humblest as well as the most triumphant fortune; they can bear the strictest review, do not change with circumstances, nor grow old with time. Force cannot rob, nor fraud cheat us of them;

Sum of the argument.

* Vid. the late ingenious Dialogue on Happiness, by J. H.

and, to crown all, instead of abating, they enhance every other pleasure.

External effects of virtue:

But the happy consequences of virtue are seen not only in the internal enjoyments it affords a man, but "in the favourable disposition of external causes towards him, to which it contributes."

On the body:

As virtue gives the sober possession of one's self and the command of one's passions, the cousequence must be heart's ease, and a fine natural flow of spirits, which conduce more than any thing else to health and long life. Violent passions, and the excesses they occasion, gradually impair and wear down the machine. But the calm, placid state of a temperate mind, and the healthful exercises in which virtue engages her faithful votaries, preserve the natural functions in full vigour and harmony, and exhilarate the spirits, which are the chief instruments of action. We might add, what will appear perhaps too refined, that as virtue is the sound temperament and beautiful complexion of the soul, so it even diffuses sometimes a congenial air of beauty over the body, lights up and spreads out the countenance into a certain openness, chearfulness, and dignity, those natural irradiations of inward worth, which politeness, that ape of virtue, may imitate, but can never fully attain.— In fine, temperance, which has been called sometimes the mother, and at other times the nurse of the virtues, is beautifully described by an ingenious author* to be that virtue without pride, and fortune without envy, that gives indolence of body and tranquillity of mind; the best guardian of youth and support of old age, the tutelar goddess of health, and universal medicine of life, that clears the head, strengthens the nerves, enlightens the eyes, and comforts the heart.

* See Temple's Miscell. Part I. Treat. 6.

It

On one's fortune, interest, &c.

It may by some be thought odd to assert, that virtue is no enemy to man's fortune in the present state of things.—But if, by fortune, be meant a moderate or competent share of wealth, power, or credit, not overgrown degress of them, what should hinder the virtuous man from obtaining that? He cannot cringe or fawn, it is true, but he can be civil and obliging as well as the knave; and surely his civility is more alluring, because it has more manliness and grace in it than the mean adulation of the other; he cannot cheat or undermine, but he may be cautious, provident, watchful of occasions, and equally prompt with the rogue in improving them; he scorns to prostitute himself as a pander to the passions, or as a tool to the vices of mankind, but he may have as sound an understanding and as good capacities for promoting their real interests as the veriest court slave; and then he is more faithful and true to those who employ him. In the common course of business, he has the same chances with the knave of acquiring a fortune, and rising in the world. He may have equal abilities, equal industry, equal attention to business; and, in other respects, has greatly the advantage of him. People love better to deal with him; they can trust him more; they know he will not impose on them, nor take advantage of them, and can depend more on his word than on the oath or strongest securities of others. Whereas what is commonly called cunning, which is the offspring of ignorance, and constant companion of knavery, is not only a mean spirited but a very short-sighted talent, and a fundamental obstacle in the road of business. It may procure indeed, immediate and petty gains, but it is attended with dreadful abatements, which do more than overbalance them, both as it sinks a man's credit when discovered, and cramps that largeness of mind which extends to the remotest as well as the nearest interest, and takes in the most durable

equally

equally with the most transient gains. It is therefore easy to see how much a man's credit and reputation, and consequently his success, depend on his honesty and virtue. The truly good man has no character to personate, no mask to wear; his designs are transparent, and one part of his discourse and conduct exactly tallies with another. Having no sordid views to promote, no mean passions to serve, but wishing well to every-body, and doing all the good he can, he is intrenched and guarded round by innocence and virtue; and though he is not secured against misfortunes, yet his character, and the friends his merit has procured him, will frequently retrieve him. Whereas tricking, as one well expresses it, is a sort of disguise, by which a man hides himself in one place, and exposes himself in another. Besides, falsehood and roguery are variable, unsettled things, and the source of a conduct both irresolute and inconsistent. They must often change hands, and be ever contriving new expedients as accidents vary; and one lame measure must always limp on after another to support and back it. So that an inexhausted fund of craft is necessary to play the knave to any purpose, and to maintain for any time a counterfeit character. When he is once detected, his credit is blown for ever; and, unless he is a great master in dissimulation, his artificial conduct will ever render him obnoxious to suspicion, which is ever sharp-sighted. Even the good man is not secure against the attacks of calumny, but he is armed against its sting. If he cannot silence, he will confute detraction, by obstinately persisting in being virtuous and doing good; in time almighty truth will prevail, and he might extort veneration from the partial, as well as obtain a chearful tribute from the candid judges of merit. But should the cloud, in which malice or envy may have involved his virtue, never be entirely dissipated in his life, yet death, that soother of

envy

envy and the malevolent passions, will totally dispel any remaining gloom, and display his character in all its genuine and unstained glory. For the bed of virtue is a bed of honour, and he who dies in it cannot die unlamented by the good, nor unreverenced by the bad.

On one's peace and security.

With regard to security and peace with his neighbours, it may be thought, perhaps, that the man of a quiet, forgiving temper, and a flowing benevolence and courtesy, is much exposed to injury and affronts from every proud or peevish mortal, who has the power or will to do mischief. If we suppose, indeed, this quietness and gentleness of nature accompanied with cowardice and pusillanimity, this may often be the case; but in reality the good man is bold as a lion, and so much the bolder for being the calmer. Such a person will hardly be a butt to mankind. The ill-natured will be afraid to provoke him, and the good-natured will not incline to do it. Besides, true virtue, which is conducted by reason, and exerted gracefully and without parade, is a most insinuating and commanding thing; if it cannot disarm malice and resentment at once, it will wear them out by degrees, and subdue them at length; how many have, by favours and prudently yielding, triumphed over an enemy, who would have been inflamed into tenfold rage by the fiercest opposition! In fine, goodness is the most universally popular thing that can be. Though the prejudices or passions of men may sometimes dress it up in the disguise of weakness, or deface it with unlovely features, yet, let the mask be dropt, and the lovely form appear as it is, the most prejudiced will respect, the unprejudiced admire and love it, and all will be afraid, or at least ashamed, to traduce or offend a thing so innocent and so godlike.

On one's family.

To conclude: the good man may have some enemies but he will have more friends, and,

having

having given so many marks of private friendship or public virtue, he can hardly be destitute of a patron to protect, or a sanctuary to entertain him, or to protect or entertain his children when he is gone. Though he should have little else to leave them, he bequeaths them the fairest, and generally the most unenvied, inheritance of a good name, which, like good seed sown in the field of futurity, will often raise up unsolicited friends, and yield a benevolent harvest of unexpected charities. But should the fragrance of the parent's virtue prove offensive to a perverse or envious age, or even draw persecution on the friendless orphans, there is one in heaven who will be more than a father to them, and recompence their parent's virtues by showering down blessings on them. The thoughts of leaving them in such good hands sustain the honest parent, and make him smile in the agonies of death; being secure that that Almighty friend, who has dispensed such a profusion of bounties to himself, cannot prove an unkind guardian, or an unfaithful trustee to his fatherless offspring.——This leads to consider a sublime motive, and noble mould to virtue, from whence it derives its firmest support, and in which it receives its highest finishing and lustre.

SECTION III.

Motives to Virtue from the Being and Providence of God.

Two external motives to virtue.

BESIDES the interesting motive mentioned in the last section, there are two great motives to virtue, strictly connected with human life, and resulting from the very constitution of the human mind. The first, is the being and providence of God; the second, is the immortality of the soul, with future rewards and punishments.

It

It appears from Sect. 4, of Book II. that man by the constitution of his nature, is designed to be a religious creature. He is intimately connected with the Deity, and necessarily dependent on him. From that connection and necessary dependence result various obligations and duties, without fulfilling which, some of his sublimest powers and affections would be incomplete and abortive. If he be likewise an immortal creature, and if his present conduct shall affect his future happiness in another state as well as in the present, it is evident, that we take only a partial view of the creature, if we leave out this important property of his nature; and make a partial estimate of human life, if we strike out of the account, or overlook, that part of his duration which runs out into eternity.—We shall therefore consider the motives which arise from the former connection in this section, and those arising from the latter in the next.

Their importance.

It is evident from the above-mentioned section*, that "to have a respect to the Deity in our temper and conduct, to venerate and love his character, to adore his goodness, to depend upon and resign ourselves to his providence, to seek his approbation, and act under a sense of his authority, is a fundamental part of moral virtue, and the completion of the highest destination of our nature."

Piety.

But as piety is an essential part of virtue, so likewise it is a great support and enforcement to the practice of it. To contemplate and admire a being of such transcendent dignity and perfection as God, must naturally and necessarily open and enlarge the mind, give a freedom and ampleness to its powers, and a grandeur and elevation to its aims. For, as an excellent divine † observes "the greatness of an object, and the excellency

A support to virtue.

* Sect. IV. Book II.

† Vid. Whichcot's Serm. Part II. Serm. VI.

of the act of any agent about a transcendent object, doth mightily tend to the enlargement and improvement of his faculties." Little objects, mean company, mean cares, and mean business, cramp the mind, contract its views, and give it a creeping air and deportment. But when it soars above mortal cares and mortal pursuits into the regions of divinity, and converses with the greatest and best of beings, it spreads itself into a wider compass, takes higher flights in reason and goodness, becomes godlike in its air and manners. Virtue is, if one may say so, both the effect and cause of largeness of mind. It requires that one think freely, and act nobly. Now what can conduce more to freedom of thought and dignity of action, than to conceive worthily of God, to reverence and adore his unrivalled excellency, to imitate and transcribe that excellency into our own nature, to remember our relation to him, and that we are the image and representatives of his glory to the rest of the creation? Such feelings and exercises must and will make us scorn all actions that are base, unhandsome, or unworthy our state; and the relation we stand in to God will irradiate the mind with the light of wisdom, and ennoble it with the liberty and dominion of virtue.

A guard and enforcement to virtue.

The influence and efficacy of religion may be considered in another light. We all know that the presence of a friend, a neighbour, or any number of spectators, but especially an august assembly of them, uses to be a considerable check upon the conduct of one who is not lost to all sense of honour and shame, and contributes to restrain many irregular sallies of passion. In the same manner we may imagine, that the awe of some superior mind, who is supposed privy to our secret conduct, and armed with full power to reward or punish it, will impose a restraint on us in such actions as fall not under the controul or animadversion of others. If we go still

still higher, and suppose our inmost thoughts and darkest designs, as well as our most secret actions, to lie open to the notice of the supreme and universal mind, who is both the spectator and judge of human actions, it is evident that the belief of so august a presence, and such awful inspection, must carry a restraint and weight with it proportioned to the strength of that belief, and be an additional motive to the practice of many duties which would not have been performed without it.—As our sense of honour or blame is increased in proportion to the esteem we have of those who bestow either, shall we suppose no sensibility to the applause or censure of him whom we believe to be the judge as well as standard of all perfection? And if we suppose such a sensibility, can we deny that it will operate, on every mind which feels it, both as an incentive to deserve that applause, and as a guard to avoid that censure? We may suppose some cases in which the virtuous man, through the force of prejudices against him, and because of the false lights in which his actions are viewed, may be tempted to renounce the honest cause by which he happens to incur reproach or ridicule. But if he can make his appeal from the opinions of men to the searcher of hearts, it is evident that the consciousness of so high a sanction may bear him out in his course, and consequently be a support to his virtue, and in due time may teach him to despise the strife of tongues, nay, the utmost efforts of malice and envy.

In cases of the greatest trial.

But a good man may likewise fall a sacrifice to power or to injustice; his life may be a series of misfortunes, and his virtue may have exposed him to many of them; the constitution and state of his body, and peculiar pressures on his mind may incapacitate him for enjoying the natural fruits of virtue, at least with an high relish. How supporting in such a case, nay, how

preservative must it be to his integrity, and what an antidote against that gloom and fretfulness which are apt to invade the mind in such circumstances of trial, to believe that infinite wisdom and goodness preside in the universe; —that every event, being under their direction, is the cause or consequence of some greater good to him, or to the whole;—that those misfortunes which befal him are appointed by heaven to correct his follies, to improve or secure his virtues, and consequently to increase his happiness! These sentiments, thoroughly felt, must and will serve as a charm to soothe his sorrows, and confirm his loyalty and resignation to the Supreme Providence.

In fine, let the disposition of external causes be ever so unfavourable to the good man, yet, as he is conscious that the Almighty Governor is his parent, patron, and friend, he may rest secure that he will either sustain and guard him in the midst of his troubles, or direct and over-rule them to his greatest good.

Exercises of piety improving to virtue.

It may be observed farther, that "to live under an habitual sense of the Deity and his great administration, is to be conversant with wisdom, order, and beauty, in the highest subjects, and to receive the delightful reflections and benign feelings which these excite while they irradiate upon him from every scene of nature and providence." How improving must such views be to the mind, in dilating and exalting it above those puny interests and competitions which agitate and enflame the bulk of mankind against each other! What genial and propitious influence on the temper must the admiration and love of divine goodness have, when it is considered as diffused through infinite space, to infinite races of creatures, and stretching from eternity to eternity! What candour, mildness, benignity of heart, and what grandeur as well as sweetness of manners, must it inspire! To conclude, with what alluring and commanding

manding energy must his benefits call forth our gratitude, his example our imitation, his wisdom, power, and goodness, our confidence and hope, his applause our ambition to deserve it! And how must his presence, strongly believed, or rather powerfully felt, enliven and fortify these and every other principle of virtue!

SECTION IV.

Motive to Virtue from the Immortality of the Soul, &c.

Metaphysical arguments for its immortality.

THE other motive mentioned was the immortality of the soul, with future rewards and punishments. The metaphysical proofs of the soul's immortality are commonly drawn from its simple, uncompounded, and indivisible nature, from whence it is concluded, that it cannot be corrupted or extinguished by a dissolution or destruction of its parts,—from its having a beginning of motion within itself, whence it is inferred, that it cannot discontinue and lose its motion,—from the different properties of matter and mind, the sluggishness and inactivity of one, and the immense activity of the other, its prodigious flight of thought and imagination, its penetration, memory, foresight, and anticipations of futurity: from whence it is concluded, that a being of so divine a nature cannot be extinguished. But as these metaphysical proofs depend on intricate reasonings concerning the nature, properties and distinctions of body and mind, with which we are not very well acquainted, they are not obvious to ordinary understandings, and are seldom so convincing even to those of higher reach, as not to leave some doubts behind them. Therefore perhaps it is not so safe to rest the proof of such an important article

article on what many may call the subtleties of school learning. Those proofs which are brought from analogy, from the moral constitution and phænomena of the human mind, the moral attributes of God, and the present course of things, and which therefore are called the moral arguments, are the plainest, and generally the most satisfying. We shall select only one or two from the rest.

Moral proof from analogy.

In tracing the nature and destination of any being, we form the surest judgment from his powers of action, and the scope and limits of these compared with his state, or with that field in which they are exercised. If this being passes through different states, or fields of action, and we find a succession of powers adapted to the different periods of his progress, we conclude that he was destined for those successive states, and reckon his nature progressive. If, besides the immediate set of powers which fit him for action in his present state, we observe another set which appear superfluous, if he was to be confined to it, and which point to another or higher one, we naturally conclude, that he is not designed to remain in his present state, but to advance to that for which those supernumerary powers are adapted. Thus we argue that the insect, which has wings forming or formed, and all the apparatus proper for flight, is not destined always to creep on the ground, or to continue in the torpid state of adhering to a wall, but is designed in its season to take its flight in air. Without this farther destination, the admirable mechanism of wings and the other apparatus would be useless and absurd. The same kind of reasoning may be applied to man, while he lives only a sort of vegetative life in the womb. He is furnished even there with a beautiful apparatus of organs, eyes, ears, and other delicate senses, which receive nourishment indeed, but are in a manner folded up, and have no proper exercise or use in their

their present confinement*. Let us suppose some intelligent spectator, who never had any connection with man, nor the least acquaintance with human affairs, to see this odd phænomenon, a creature formed after such a manner, and placed in a situation apparently unsuitable to such various machinery, must he not be strangely puzzled about the use of his complicated structure, and reckon such a profusion of art and admirable workmanship lost on the subject; or reason by way of anticipation, that a creature endued with such various yet unexerted capacities was destined for a more enlarged sphere of action, in which those latent capacities shall have full play? The vast variety and yet beautiful symmetry and proportions of the several parts and organs with which the creature is endued, and their apt cohesion with, and dependance on, the curious receptacle of their life and nourishment, would forbid his concluding the whole to be the birth of chance, or the bungling effort of an unskilful artist; at least, would make him demur a while at so harsh a sentence. But if, while he is in this state of uncertainty, we suppose him to see the babe, after a few successful struggles, throwing off his fetters, breaking loose from his little dark prison, and emerging into open day, then unfolding his recluse and dormant powers, breathing in air, gazing at light, admitting colours, sounds, and all the fair variety of nature; immediately his doubts clear up, the propriety and excellency of the workmanship dawn upon him with full lustre, and the whole mystery of the first period is unravelled by the opening of this new scene. Though in this second period the creature lives chiefly a kind of animal life, *i. e.* of sense and appetite, yet by various trials and observations he gains experience, and by the gradual evolution of the powers of imagination he

* Vid. Ludov. Viv. de Rel. Christ. Lib. II. de Vita Uteri, &c.

ripens

ripens apace for an higher life, for exercising the arts of design and imitation, and of those in which strength or dexterity are more requisite than acuteness or reach of judgment. In the succeeding rational or intellectual period, his understanding, which formerly crept in a lower, mounts into an higher sphere, canvasses the natures, judges of the relations of things, forms schemes, deduces consequences from what is past, and from present as well as past collects future events. By this succession of states, and of correspondent culture, he grows up at length into a moral, a social and a political creature. This is the last period at which we perceive him to arrive in this his mortal career. Each period is introductory to the next succeeding one; each life is a field of exercise and improvement for the next higher one, the life of the fœtus for that of the infant, the life of the infant for that of the child, and all the lower for the highest and best*.—But is this the last period of nature's progression? is this the utmost extent of her plot, where she winds up the drama, and dismisses the actor into eternal oblivion? or does he appear to be invested with supernumerary powers, which have not full exercise and scope, even in the last scene, and reach not that maturity or perfection of which they are capable; and therefore point to some higher scene, where he is to sustain another and more important character than he has yet sustained? If any such there are, may we not conclude by analogy, or in the same way of anticipation as before, that he is destined for that after-part, and is to be produced upon a more august and solemn stage, where his sublimer powers shall have proportioned action, and his nature attain its completion?

Powers in man which point to an after-life.

If we attend to that curiosity, or prodigious thirst of knowledge, which is natural to the mind in every period of its progress, and consider

* See Butler's Analogy, Part, I.

withal

withal the endless round of business and care, and the various hardships to which the bulk of mankind are chained down, it is evident that in this present state it is impossible to expect the gratification of an appetite at once so insatiable and so noble. Our senses, the ordinary organs by which knowledge is let into the mind, are always imperfect, and often fallacious; the advantages of assisting or correcting them are possessed by few; the difficulties of finding out truth amidst the various and contradictory opinions, interests, and passions of mankind, are many; and the wants of the creature, and of those with whom he is connected, numerous and urgent; so that it may be said of most men, that their intellectual organs are as much shut up and secluded from proper nourishment and exercise in that little circle to, which they are confined, as the bodily organs are in the womb. Nay, those who to an aspiring genius have added all the assistances of art, leisure, and the most liberal education, what narrow prospects can even they take of this unbounded scene of things from that little eminence on which they stand? And how eagerly do they still grasp at new discoveries, without any satisfaction or limit to their ambition?

Intellectual.

But should it be said, that man is made for action, and not for speculation, or fruitless searches after knowledge, we ask for what kind of action? Is it only for bodily exercises, or for moral, political, and religious ones? Of all these he is capable; yet by the unavoidable circumstances of his lot, he is tied down to the former, and has hardly any leisure to think of the latter, or, if he has, wants the proper instruments of exerting them. The love of virtue, of one's friends and country, the generous sympathy with mankind, and heroic zeal of doing good, which are all so natural to great and good minds, and some traces of which are found in the lowest, are seldom united with proportioned

Moral powers.

means or opportunites of exercising them; so that the moral spring, the noble energies and impulses of the mind, can hardly find proper scope even in the most fortunate condition; but are much depressed in some, and almost intirely restrained in the generality, by the numerous clogs of an indigent, sickly, or embarrassed life. Were such mighty powers, such god-like affections, planted in the human breast to be folded up in the narrow womb of our present existence, never to be produced into a more perfect life, nor to expatiate in the ample career of immortality?

Unsatisfied desires of existence and happiness, &c.

Let it be considered, at the same time, that no possession, no enjoyment, within the round of mortal things is commensurate to the desires, or adequate to the capacities of the mind. The most exalted condition has its abatements, the happiest conjuncture of fortune leaves many wishes behind, and, after the highest gratifications, the mind is carried forward in pursuit of new ones without end. Add to all, the fond desires of immortality, the secret dread of non-existence, and the high unremitting pulse of the soul beating for perfection, joined to the improbability or the impossibility of attaining it here; and then judge whether this elaborate structure, this magnificent apparatus of inward powers and organs, does not plainly point out an hereafter, and intimate eternity to man? Does nature give the finishing touches to the lesser and ignobler instances of her skill, and raise every other creature to the maturity and perfection of his being, and shall she leave her principal workmanship unfinished? Does she carry the vegetative and animal life in man to their full vigour and highest destination, and shall she suffer his intellectual, his moral, his divine life to fade away, and be for ever extinguished? Would such abortions in the moral world be congruous to that perfection of wisdom and goodness, which upholds and adorns the natural?

We

Therefore man immortal.

We must therefore conclude, from this detail, that the present state, even at its best, is only the womb of man's being, in which the noblest principles of his nature are in a manner fettered, or secluded from a correspondent sphere of action, and therefore destined for a future and unbounded state, where they shall emancipate themselves, and exert the fulness of their strength. The most accomplished mortal, in this low and dark apartment of nature, is only the rudiments of what he shall be when he takes his ethereal flight, and puts on immortality. Without a reference to that state, man were a mere abortion, a rude unfinished embryo, a monster in nature. But this being once supposed, he still maintains his rank of the master-piece of the creation; his latent powers are all suitable to the harmony and progression of nature; his noble aspirations, and the pains of his dissolution, are his efforts towards a second birth, the pangs of his delivery into light, liberty, and perfection; and death, his discharge from gaol, his separation from his fellow-prisoners, and introduction into the assembly of those heroic spirits who are gone before him, and of their great eternal parent. The fetters of his mortal coil being loosened, and his prison-walls broke down, he will be bare and open on every side to the admission of truth and virtue, and their fair attendant, happiness; every vital and intellectual spring will evolve itself with a divine elasticity, in the free air of heaven. He will not then peep at the universe and its glorious author through a dark grate, or a gross medium, nor receive the reflections of his glory through the strait openings of sensible organs, but will be all eye, all ear, all ethereal and divine feeling*.—Let one part however of the analogy be attended to; that as in the womb we re-

* Vid. Religion of Nature, § 9.

ceive our original constitution, form, and the essential stamina of our being, which we carry along with us into the light, and which greatly affect the succeeding periods of our life; so our temper and condition in the future life will depend on the conduct we have observed, and the character we have formed in the present life. We are here in miniature what we shall be at full length hereafter. The first rude sketch or out-lines of reason and virtue must be drawn at present, to be afterwards enlarged to the stature and beauty of angels.

Immortality a guard and incentive to virtue.

This, if duly attended to, must prove not only a guard, but an admirable incentive to virtue. For he who faithfully and ardently follows the lights of knowledge, and pants after higher improvements in virtue, will be wonderfully animated and inflamed in that pursuit by a full conviction that the scene does not close with life—that his struggles arising from the weakness of nature and the strength of habit will be turned into triumphs—that his career in the track of wisdom and goodness will be both swifter and smoother—and those generous ardours with which he glows towards heaven, *i. e.* the perfection and immortality of virtue, will find their adequate object and exercise in a sphere proportionably enlarged, incorruptible, immortal. On the other hand, what an inexpressible damp must it be to the good man, to dread the total extinction of that light and viritue, without which life, nay, immortality itself, were not worth a single wish?

Proof from the inequality of present distribution.

Many writers draw their proofs of the immortality of the soul, and of a future state of rewards and punishments, from the unequal distribution of these here. It cannot be dissembled, that wicked men often escape the outward punishment due to their crimes, and do not feel the inward in that measure their demerit seems to require, partly from

from the callousness induced upon their nature by the habits of vice, and partly from the dissipation of their minds abroad by pleasure or business—and sometimes good men do not reap all the natural and genuine fruits of their virtue, through the many unforeseen or unavoidable calamities in which they are involved. This, no doubt, upon the supposition of an all-wise and good providence, were an argument, and a strong one too, for a future state, in which those inequalities shall be corrected. But unless we suppose prepollent good order in the present scene of things, we weaken the proof of the divine administration, and the presumption of any better order in any future period of it.

Belief of immortality, &c. a great support amidst trials.

From section the second of this book it appears, that virtue has present rewards and vice present punishments annexed to it, such rewards and punishments as make virtue, in most cases that happen, far more eligible than vice; but in the infinite variety of human contingencies, it may sometimes fall out, that the inflexible practice of virtue shall deprive a man of considerable advantages to himself, his family, or friends, which he might gain by a well-timed piece of roguery; suppose, by betraying his trust, voting against his conscience, selling his country, or any other crime, where the security against discovery shall heighten the temptation. Or, it may happen, that a strict adherence to his honour, to his religion, to the cause of liberty and virtue, shall expose him, or his family, to the loss of every thing, nay, to poverty, slavery, death itself, or to torments far more intolerable. Now what shall secure a man's virtue in circumstances of such trial? What shall enforce the obligations of conscience against the allurements of so many interests, the dread of so many and so terrible evils, and the almost unsur-

mountable

mountable aversion of human nature to excessive pain? The conflict is the greater, when the circumstances of the crime are such as easily admit a variety of alleviations from necessity, natural affection, love to one's family, or friends, perhaps in indigence; these will give it even the air of virtue. Add to all, that the crime may be thought to have few bad consequences,—may be easily concealed,—or imagined possible to be retrieved in a great measure by future good conduct. It is obvious to which side most men will lean in such a case; and how much need there is of a balance in the opposite scale, from the consideration of a God, of a Providence, and of an immortal state of retribution, to keep the mind firm and uncorrupt in those or like instances of singular trial, or distress.

In the general course of life.

But without supposing such peculiar instances, a sense of a governing mind, and a persuasion that virtue is not only befriended by him here, but will be crowned by him hereafter with rewards suitable to its nature, vast in themselves, and immortal in their duration, must be not only a mighty support and incentive to the practice of virtue, but a strong barrier against vice. The thoughts of an almighty judge and of an impartial future reckoning are often alarming, inexpressibly so, even to the stoutest offenders. On the other hand, how supporting must it be to the good man to think that he acts under the eye of his friend, as well as judge! How improving, to consider the present state as connected with a future one, and every relation in which he stands as a school of discipline for his affections; every trial as the exercise of some virtue; and the virtuous deeds which result from both, as introductory to higher scenes of action and enjoyment! Finally, how transporting is it to view death as his discharge from the warfare

of

of mortality, and a triumphant entry into a state of freedom, security, and perfection, in which knowledge and wisdom shall break upon him from every quarter; where each faculty shall have its proper object; and his virtue, which was often damped or defeated here, shall be enthroned in undisturbed and eternal empire!

Advantages of the Christian scheme, and its connection with natural religion or morality.

On reviewing this short system of morals, and the motives which support and enforce it, and comparing both with the Christian scheme, what light and vigour do they borrow from thence? How clearly and fully does Christianity lay open the connections of our nature, both material and immaterial, and future as well as present! What an ample and beautiful detail does it present of the duties we owe to God, to society, and ourselves, promulgated in the most simple, intelligible, and popular manner; divested of every partiality of sect or nation; and adapted to the general state of mankind! With what bright and alluring examples does it illustrate and recommend the practice of those duties; and with what mighty sanctions does it enforce that practice! How strongly does it describe the corruptions of our nature; the deviations of our life from the rule of duty; and the causes of both! How marvellous and benevolent a plan of redemption does it unfold, by which those corruptions may be remedied, and our nature restored from its deviations to transcendent heights of virtue and piety! Finally, what a fair and comprehensive prospect does it give us of the administration of God, of which it represents the present state only as a small period; and a period of warfare and trial! How solemn and unbounded are the scenes which it opens beyond it: the resurrection of the dead, the general judgment, the equal distribution of rewards and punishments to the good and bad; and the full com-

pletion

pletion of divine wisdom and goodness in the final establishment of order, perfection, and happiness!—How glorious then is that scheme of religion, and how worthy of affection as well as of admiration, which, by making such discoveries, and affording such assistances, has disclosed the unfading fruits and triumphs of virtue, and secured its interests beyond the power of time and chance!

CONCLUSION.

Recapitulation.

WE have now considered the constitution and connections of man, and deduced the several duties resulting from both. We have investigated some of the methods by which his constitution may be preserved in a sound and healthful state, or restored to it. We have inquired into the final causes of his constitution, and found its admirable harmony with his situation. And, lastly, we have enumerated the principal motives which enforce the practice of the duties incumbent on a creature so constituted and so situated.

Result.

From this deduction it appears, that "man is a creature endued with a variety of senses, powers, and passions, subject to a variety of wants and dangers, environed with many natural, and capable of forming many civil connections; bound to many duties in consequence of such a nature, such a situation, and such connections, and susceptible of many enjoyments in the discharge of them."—It farther appears, that "the sum of those duties may be reduced to such a conduct of his senses, powers, and passions, as is duly proportioned to his wants, to his dangers, and to his connections;—that this conduct is most

most approved in the mean time, and yields the most refined and lasting pleasures afterwards; that particularly the exercise of the public affections is attended with enjoyments the greatest in dignity and duration;—and in the largest sum of such pleasures and enjoyments his highest happiness consists. Therefore, to keep those refined sources of enjoyment always open, and in cases of competition, to sacrifice the lower kinds, *i. e.* those of sense and appetite, to the higher, *i. e.* to those of reason, of virtue, and piety, is not real self-denial, but the truest wisdom, and the justest estimate of happiness.—And to shut up the noblest springs, or to sacrifice the higher to the lower kinds, is not self-indulgence, but the height of folly, and a wrong calculation of happiness."

The happiest youth.

Therefore he who, in his youth, improves his intellectual powers in the search of truth and useful knowledge; and refines and strengthens his moral and active powers, by the love of virtue, for the service of his friends, his country, and mankind; who is animated by true glory, exalted by sacred friendship for social, and softened by virtuous love for domestic life; who lays his heart open to every other mild and generous affection, and who to all these adds a sober masculine piety, equally remote from superstition and enthusiasm; that man enjoys the most agreeable youth, and lays in the richest fund for the honourable action and happy enjoyment of the succeeding periods of life.

The happiest manhood.

He who, in manhood, keeps the defensive and private passions under the wisest restraint; who forms the most select and virtuous friendships; who seeks after fame, wealth, and power, in the road of truth and virtue, and, if he cannot find them in that road, generously despises them; who, in his private character

and connections, gives fullest scope to the tender and manly passions, and in his public character and connections serves his country and mankind in the most upright and disinterested manner; who, in fine, enjoys the goods of life with the greatest moderation, bears its ills with the greatest fortitude, and in those various circumstances of duty and trial maintains and expresses an habitual reverence and love of God; that man is the worthiest character in this stage of life: passes through it with the highest satisfaction and dignity, and paves the way to the most easy and honourable old age.

The happiest old age.

Finally, he who, in the decline of life, preserves himself most exempt from the chagrins, incident to that period; cherishes the most equal and kind affections; uses his experience, wisdom, and authority, in the most fatherly and venerable manner; acts under a sense of the inspection, and with a view to the approbation, of his maker; is daily aspiring after immortality, and ripening apace for it; and, having sustained his part with integrity and consistency to the last, quits the stage with a modest and graceful triumph; this is the best, this is the happiest old man.

The happiest life.

Therefore that whole life of youth, manhood, and old age, which is spent after this manner, is the best and happiest life.

The good man.

"He, who has the strongest original propension to such sentiments and dispositions, has the best natural temper." "He, who cultivates them with the greatest care, is the most virtuous character." "He, who knows to indulge them in the most discreet and consistent manner, is the wisest." "And he, who, with the largest capacities, has

The virtuous; The wise;

has the best opportunities of indulging them, is the most fortunate." The fortunate man.

"To form our life upon this plan, is to follow nature," that is to say, "to act in a conformity to our original constitution, and in a subordination to the eternal order of things. And, by acting in this manner (so benevolently we are formed by our common parent!) we effectually promote and secure our highest interest." Thus, at last it appears (and who would not rejoice in so divine a constitution?) that "duty, wisdom, and happiness coincide, and are one." A life according to nature. Duty, wisdom, and happiness are one.

To conclude: "virtue is the highest exercise and improvement of reason; the integrity, the harmony and just balance of affection; the health, strength, and beauty of the mind." "The perfection of virtue is to give reason free scope; to obey the authority of conscience with alacrity; to exercise the defensive passions with fortitude; the private with temperance; the public with justice; and all of them with prudence; that is, in a due proportion to each other, and an intire subserviency to a calm diffusive benevolence:—to adore and love God with a disinterested and unrivalled affection; and to acquiesce in his providence with a joyful resignation. Every approach to this standard is an approach to perfection and happiness. And every deviation from it, a deviation to vice and misery." The sum and perfection of virtue.

From this whole review of human nature, the most divine and joyful of all truths breaks upon us with full evidence and lustre; "that man is liberally provided with senses and capacities for enjoying happiness; furnished with means for attaining it; taught by his nature where it lies; prompted by his passions within, and his condition without, powerfully to seek it; and, A noble and joyful corollary.

and, by the wise and benevolent order of heaven, often conducted to the welfare of the particular, and always made subservient to the good of the universal system."

THE END.

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